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INDEX TO VOLUME 32

Illustrations are in bold face.

Abies, 65, **76**
Abnormal Leaf Retention on Introduced Trees in Autumn 1971, Alfred J. Fordham, 290
Acer, 241, 247
— *griseum*, 290, **291**
— *japonicum*, 70
— *negundo*, 65, **66**
— *palmatum*, **70**, 290
— *pensylvanicum*, **70**
— *platanoides*, 69, 290
— *pseudoplatanus*, 70
— *rubrum*, **69**
— *saccharinum*, **69**
— *saccharum*, **69**
— *sieboldianum*, 70
— *tataricum*, 70
Administration Building 1890, **7**
Adonis amurensis, bonsai, 245
Aesculus, 63
Agapanthus, 220
Ageratum conyzoides, 25
Ailanthus altissima, **67**, **78**
Air pollution, 228
Akebia x *pentaphylla*, **35**
Albizia julibrissin, 69, **85**
Alder, **82**
Alnus, **82**
Aloe divaricata, 25
Amelanchier, 84
American Association of Botanical Gardens and Arboreta, **251**, 253
American Society of Horticultural Sciences, N. E. Section Meeting at the Arboretum, 126, 268
America's Greatest Garden, E. H. Wilson, 51
Ames, Oakes, 5, 8, 9
Ammi visnaga, 201
Amur maackia, 67
Anabe, 29
Anadenanthera colubrina, 208
— *peregrina* in fruit, **208**
Anamaloho, 29
Anderson, Edgar, 53
Andrarika, 25
Anguria, 213
Anthurium Tessmannii, 216
Antibiotics, 201
Anti-hemorrhagic agent, 46
— — —, Madagascar, 27
Antispasmodic, Madagascar, 25
Antisyphilitic, Madagascar, 25
Apple, 84
— scab, 127
Apples, 126–132, see also *Malus*
— 'Cortland', 126, 132
— 'Golden Delicious', 130
— 'Golden Russet', 130
— 'McIntosh', 128, 132
— 'Roxbury Russet', 130
Apricot, 282
Aralia spinosa, 68
Arbol de los Brujos, 209
Arboretum Administrators: An Opinionated History, The, S. B. Sutton, 3–20
Arboretum controversy, 19
Arboretum et Fruticetum Britannicum, John Claudius Loudon, 185
Arborvitae, 65
Archbold Expeditions, 53
Argyle, Duke of, 185
Aristocrats of the Garden, E. H. Wilson, 51
Aristolochia medicinalis, 214
Arnold Arboretum Achievement Award, 260
— — Plant Introductions: The Second Fifty Years 1923–1972, Donald Wyman, 30–43
— Fund, 175
—, James, 4, 49, 174
— Professor, 175
Arnoldia, 51, 271

Arnoldia in the Kitchen, Helen Roca-Garcia: Linden Tea, 166
— —, —: Persimmon Pudding, 98
Arrabidea xanthophylla, 214
Arrow-poisons, South America, 201
Ash, 66
—, European, 67
—, Green, 67
—, White, 67
Aspen, Big-tooth, 80
—, Quaking, 80
Aspidosperma, 213
Asters, 113
Atanoushi Province, Madagascar, 23
Atkins Garden, Cuba, 10, 13
Aucuba, 241
Awards, 165
Ayahuasca, 205, 210
Azalea, bonsai, 242
—, Kurume, 245
Azonualala, 29

Babiana villosa, 222
Bailey, I. W. 12, 53
Bald cypress, 283
Banisteriopsis, 205, 210
— *Caapi,* 211, 215
— *inebrians,* 211
— *Rusbyana,* 211, 215
Bartram, John, 184
Bean, W. J., 185
Beautybush, 71, 86
Bedford, Duke of, John Russell, 188
Beech, American, 83
—, European, 83, 91
—, Fernleaf, 73
Betula, 93
— *lenta,* 81
— *lutea,* 82, 93
— *papyrifera,* 81
— *pendula,* 73, 80, 81, 93
Bibliography of Cultivated Woody Plants, Alfred Rehder, 51
— of Eastern Asiatic Botany, Merrill & Walker, 54
Bigelow, Jacob, 187
Birch, 93
—, European Cutleaf, 73
—, — Weeping, 80, 81, 93
—, Paperbark, 81
—, Sweet, 81
—, Yellow, 82, 93
Black Gum, 91
Bladdernut, 65, 77
Blushing Bride, 220
Bonsai, 241–249
—, miniature, 247
— vendor at Yasukuni National Shrine, No. 5 cover 3
Books, Gardening, for libraries, 116–125
Borreria verticillata, 25
Boston Center for the Performing Arts, 252
— Park Department, 251
— Poison Center, 254
— Public Garden, 252
— Society of Landscape Architects, 254
Botanic Garden, Berlin, 151
— —, Cambridge, 190
— —, Edinburgh, 190
— —, Kew, 103, 189
— —, Oxford, 190
— —, Paris, 103
— —, St. Pierre, Martinique, 263
— Gardens, South Africa, National, 220–223
Botanical Museum, 10, 12
Bouncing Bet, 136, 137
Box Elder, 65, 66
Bradley Bibliography, Alfred Rehder, 54, 153, 185
Brass, Leonard, 53
Brexia madagascariensis, 29
Broadbalk Wilderness, 176
Bromeliad Society, 260
Brugmansia, 209
Brunfelsia, 209, 216, 217
Bruns, Pamela, 250
Buddleia, 160
— *alternifolia,* 41
Bulbs, 275
Bulletin of Popular Information, 51
Buna, bonsai, 247
Burningbush, Broadleaf, 70
Bussey Institution, 12, 49
Butternut, 68

Caapi, 205, 210
Cacti collection, 259
Caffe weede, 45

Cajanus cajan, 27
Calea zacatechichi, 207
Cambridge, new building, 17
Camellia, bonsai, 241, 246
Campbell, Archibald, 185
Campsoneura capitellata, 216
— *debilis*, 216
Cancer Chemotherapy National Service Centre of the National Institute of Health, 200
Canephora madagascariensis, 27
Capsella bursa-pastoris, 44, 45
Capsicum frutescens, 25
Captan, 163
Caragana arborescens, 67
Carpinus, 82, 93
— *betulus*, **101**, No. 6 cover 3
Carya glabra, 68
— *ovata*, 68, 79
— *tomentosa*, 68
Caryocar, 212
Caryophyllaceae, 136
Case Estates, 14, 260
— Park, 252, 261
— Sisters, Louisa & Marian, 14
Cassia occidentalis, 25
Castanea, 83
Catalogue of the Library of the Arnold Arboretum, Ethelyn Tucker, 54
Catalpa, 69, 71, 86
Catharanthus roseus, 27
Cayaponia ophthalmica, 214
Cébil, 208
Cedar of Lebanon, 64
Cedrus libani, 64
Celtis, 84
Centennial Committee, 250
— week at the Arnold Arboretum, No. 4 cover 1, 157–159, 249
— Year, 249
Cercidiphyllum, 271
— *japonicum*, 70, 80, 250
Cercis, 91, 97
Chamaecyparis, 65
— *obtusa*, bonsai, 242, 246
Channel 2 crew at Arboretum, 266, 267
Cherries at Arnold Arboretum, 50
Cherry, 84
Chestnut, 83
Chillingham Park, Northumberland, 180
China, map, **105**
—, Wilson's first trip to, 103–114
China, Mother of Gardens, E. H. Wilson, 51
Chionanthus retusus, 72
— *virginicus*, 72, 88
Chiric-kaspi, 216
Chontal Indians, 207
Chrysanthemum, bonsai, 245
Cimora, 211
City trees, identification, 59–97
Cladrastis lutea, 67
Clappe de pouch, 45
Clark, Robert B., The "Rochester" Strain of Lilacs, 133–135
Claviceps purpurea, 207
Clement, Harmony, 250
Cockchafer beetle, 179
Coffee substitute, Madascar, 25
Coggeshall, Roger, 51
Coleus, 207
Collinson, Peter, 184
Compton, Henry, 179
Comptonia, 180
Connarus opacus, 212
— *sprucei*, 212
Conocybe, 205
Conomorpha lithophyta, 213
— *magnoliifolia*, 213
Constable, John, 183
Contributions from the Arnold Arboretum, 52
Controlled atmosphere storage, 131
Cooley, George R., 270
Cooperating Nurseryman's Program, 51
Coriaria thymifolia, 211
Cork Tree, 66
Cornelian Cherry, bonsai, 246
Cornus, 71
— *alba* 'Siberica', 278
— *baleyi*, 278
— *florida*, 71, 87
— *kousa*, 72, 88
— — var. *chinensis*, **101**
— — 'Steeple', 277
— *mas*, 39
— *stolonifera*, 41, 278
— — 'Cheyenne', 277
— — *coloradensis*, 277

Cortisone, 201
Cotinus, 91, 97
Cottonwood, Eastern, 81
Cough remedy, Madagascar, 25
Council on the Arts and Humanities of Mass., 265
Crataegus, 9, 73, 81, 84
Cruso, Thalassa, 266, 267
Cryptomeria, 241
Cucumber tree, 90
Culebra-borrachero, 209
Curare, 201, 212
Cuttings, softwood, 160
Cycas revoluta, bonsai, 243
Cynodon dactylon, 27

Dana greenhouse, 259, 260
Datura, 205
— *candida,* 209
David, Abbé Armand, 103
Davidia involucrata, No. 3 cover 1, 103
Dawn Redwood, 55
Dawson, Jackson, 4, 51
Deer Parks, English, 180
Defoliants in tropical jungles, 53
Derderian, Constance E., 269
Desanos Indians, Colombia, 213
Desfontainia spinosa var. *Hookerii,* 211
Deutzia, 113
Devil's Walkingstick, 68
DeWolf, Gordon P., 254
—, Gardening Books for Libraries, 115–125
Dinitro-ortho-cresol, 129
Diphenylamine, 132
Director's Report, Richard A. Howard, 249–278
Diarrhea remedy, Madagascar, 25
— —, Colonial U.S., 46
Diospyros kaki, 98
— *virginiana,* 91, 98
Displays by Arnold Arboretum, 250, 269
Dixwell, John James, 175
Dodoneus, D. Rembertus, 45
Dogwood, 71
—, Flowering, 71, 87
—, Japanese, 277
—, Kousa, 72, 88
Dove Tree, 103
Downing, Andrew Jackson, 174, 185, 187
D P A, 132
Duda, Heidi, 252
Duroia, 213
Dutch Elm disease, 54

Earache remedy, Madagascar, 27
Early Botanical Books, 249, 272
Edible and Poisonous Plants of the Islands of the Pacific, E. D. Merrill, 53
Education at Arnold Arboretum, 265
Ehrlich, Paul R., 237
—, The Hysteria Against the Case: The Population-Environment Crisis — Where Do We Go From Here? 226–240
Eleagnus angustifolia, 90
Elias, Dr. Thomas, 252
Eliot, Charles, 6
Elm, 81, 82
Elwes, Henry John, 185, 188, 189
Emerson, George B., 174
English Deer Park, 174
— Woodlands 16th, 17th centuries, 176
Environmental deterioration, 228
Epená, 207
Ergot, 207
Errata, 114
Erythroxylon, 25
6-ethoxy-1,2 dihydro-2,2,4-trimethyl quinoline, 132
Ethoxyquin, 132
Euonymus, 241
— *latifolia,* 70
Eutin, Germany, 143
Evelyn, John, 177, 183
Exhibit, Spring Flower Show, 269
Exponential growth, 234
Ezo-matsu, bonsai, 246

Fagus crenata, bonsai, 242, 247
— *grandifolia,* 83
— *sylvatica,* 83, 91
— — var. *laciniata,* 73
Faingalala, 25
False Cypress, 65
Famonta, 25
Famonto kely, 25

Fandlikatany, 27
Fandrosarana, 27
Fatsia, 241
Faull, J. Horace, 12, 54
Faxon, C. E., 7, 20, 52, 189
Fenicchia, Richard A., 133
Fermate, 128
Fernald, Merritt L., 13
Fever remedy, Madagascar, 27
Field class at Arboretum, No. 6 cover 1
Filmore, Richard, 51
Fir, 65, 76
—, Douglas, 65, 185
— needles, 64
Firethorn, bonsai, 247
de Flacourt, Etienne (Stephenne), 23
Flacourtia, 23
— *indica*, 23
Flemer, William, 250
Flesh of the Gods, 205
Foliage, Autumn 1971, 290
Forbes, James, 188
Fordham, Alfred J., 51, 105, No. 4 cover 3, 253
—, Abnormal Leaf Retention on Introduced Trees in Autumn 1971, 290
—, A Simple Frame for Softwood Propagation, 160–164
—, Weather Station Data 1971, 289
Forsythia, 50
Fragaria major, 272
Fraim, Mrs. Irving, 270
Frame for propagation, 161, 164
Fraxinus, 66
— *americana*, 67
— *excelsior*, 67
— *pensylvanica*, 67
Frederick, Prince of the Netherlands, 145
Freesia, 220
Friends of the Arnold Arboretum, 55
Fringetree, Chinese, 72
—, White, 72, 88
From Medieval Park to Modern Arboretum: The Arnold Arboretum and its Historic Background, William T. Stearn, 173–197
From Witch Doctor to Modern Medicine: Searching the American Tropics for Potentially New Medicinal Plants, Richard Evans Schultes, 198–219
Fulham, Arboretum at, 179, 192–195
Fuller's Herb, 136

Garden and Forest, 51
Garden Club of America, Medal of Honor, 165
Gardener, William, E. H. Wilson's First Trip to China, 103–113
Gardening Books for Libraries, Gordon P. DeWolf, 115–125
Garnier, Francis, 109
Geary, Sheila, 265
Generic Flora of the Southeastern United States, 55
Gentians, 113
Gerard, John, 136
Gerard's Herball, 166
Gerbera, 220
Gerberia crenata, No. 5 cover 1
Gifts 1972, 270
Ginkgo, 285
Ginkgo biloba, 63
Gladiolus, 220
Gladiolus carneus, 222
— *recurvus*, 222
Gleditsia triacanthos, 67, 68
— — *inermis* 'Royal Green', 278
Goldenchain Tree, 66, 77
Golden Rain Tree, 69, 85
Gomez-Pompa, Arturo, 263
Gomortega Keule, 211
Governor's Plum, 23
Goyo-matsu, bonsai, 246
Gray, Asa, 6, 49, 175
Green committee, Harvard, 254
Green revolution, 230
Grenville, Lord of Dropmore, 185
Grunfeld Park, 149
Guide program, 252
Guide to City Trees in the Boston Area, Richard E. Weaver, 59–97
Gurania, 213
Gymnocladus dioicus, 69

Hackberry, 84

Halesia, 95
— *carolina,* 84
Hall, Mrs. Norton, 265
Hamamelis, 81, 82
—, 'Arnold Promise', 39, 51
Hance, Dr. J. F., 109
Hancock, William, 109
Harvard Botanic Garden, 10, 49
— corporation, 3, 17
— University, 174, 254
— — Herbaria, 200, 262
Harvest drop, 128
Hauser, Rick, 266
Hawthorn, 17, 73, 81, 84
Hay, Ida, 253
Hazongalala, 27
Heath, 224
Hebb, Robert S., 260
—, Plant Registration, 277–287
Helichrysum, 25
Helosis guyannensis, 214, 217
Hemerocallis, 261
Hemlock, 65, 76
Henry, Augustine, 103, 185, 189
Herbs and fruits of Madagascar, 23–29
Herdys Purse, 45
Hermann von Arnim, Count, 149
Hess, Charles, No. 4, cover 3
Heteropteris macrostachya, 214
— *riparia,* 214
HEW, 205
Hickory, Shagbark, 68, 79
Himatanthus, 213
Hinoki, bonsai, 246
Hiraea apaporiensis, 214
— *schultesii,* 214
Hodge, Walter H., 248
—, Japanese Bonsai and Bonsai Shows, 214–249
Hoffman, M. B., One Hundred Years of Apples, 126–132
Honey Locust, 67, 68, 278
Hooker, Sir Joseph, 6, 50
Hop Hornbeam, 82, 94
Hornbeam, 82, 93
Horse Chestnut, 63
Horticultural Society, Massachusetts, 187, 268
— —, Worcester County, 268
Hovey, Chandler, 165, 255
Howard, Richard A., 5, 17, 18, 53, 165, No. 4 cover 3, 253, 262
—, The Director's Report, 249–276
—, Scientists and Scientific Contributions of the Arnold Arboretum, the First Century, 49–58
Hu, Shiu-Ying, 263, 268
Hull, Rear Admiral Harry, 250
Hunnewell, Horatio Hollis, 6, 187, 188
Hunnewells, 176
Hurricane 1938, 14
Hydrangea, panicle, 71, 86
Hydrangea paniculata, 71, 86
Hypertension remedy, Madagascar, 27
Hysteria Against the Case: The Population-Environment Crisis — Where Do We Go From Here?, The, Paul R. Ehrlich, 226–240

Ichang Fu, China, 107
Ilex, bonsai, 247
International Plant Propagators' Society Award of Merit, 165
— — — — Plaque, presented to Arnold Arboretum, No. 4 cover 3
International Society for Horticultural Science, 51
Introduction of trees and shrubs to England, 184
Introductions by Arnold Arboretum, 2nd 50 years, 30–43
Iochroma, 210
Ipomoea violacea, 205
Iryanthera crassifolia, 216
— *longifolia,* 216
— *polyneura,* 216
— *tricornis,* 216
— *Ulei,* 216

Jack, J. G., 14, 50, 52, 189
Japanese Bonsai and Bonsai Shows, W. H. Hodge, 241–249
Jardin des Plantes, Paris, 103
Jasminum Mesnyi, 109, 110
— *primulinum,* 108
Jaundice remedy, Madagascar, 25

Jefferson, Thomas, 187
Jewett Fund Awards, 258
Johnston, I. M., 53
Journal of South African Botany, 221
Journal of the Arnold Arboretum, The, 52, 271
Judd, William, 51
Juglans, 68
— *cinerea,* 68
— *nigra,* 68
Junior Citation received by George Pride, 261
Juniper, 64, 65, 76
Juniperus, 64, 65, 76
— *chinensis* 'Gold Star', 278
— — 'Old Gold', 278
— — 'Pfitzeriana Aurea', 278
— *rigida,* bonsai, 246
Justicia pectoralis var. *stenophylla,* 207, 211

Kaempfer, Englebert, 241
Kato-kato, 27
Katsura Tree, 70, 80
Kentucky Coffee Tree, 69
Keyaki, bonsai, 247
Khellin, 201
Kildo, 25
Kirstenbosch, Botanic Garden of South Africa, 221
Kniphofia, 220
Kobuski, C. E., 52
Koelreuteria paniculata, 69, **85**
Kofan Indians, 212
Kolkwitzia amabilis, 71, **86**
Kraus, Gregor, 184
Krussmann, G., 185
Kubeo Indians, Colombia, 212
Kuripakos Indians, 213
Kurme in Kyushu, bonsai, 245
Kuro-matzu, bonsai, 246

Laburnum, 66, 77
Landscape painting, 183
Lantana aculeata, 27
Larch, 64, 75, 184, 241, 285
Larix decidua, 184
— — 'Paula', 279
Latua pubiflora, 209
Lawsuit vs. Harvard University, 19
Leaf characteristics, **60**
Lectures by Arboretum staff, 267
Lemoine, Emile, 133
—, Victor, 133
Leukemia remedy, Madagascar, 27
Levett, William, 177
Library, Arnold Arboretum, 265
Liebes, Sidney, 226
Lilac cultivars, 133–135
—, Tree, 72
Lilacs at A. A., 50, **125**
—, "Rochester" Strain, 133–135
Lilies, 113
Lilium auratum X *L. speciosum,* 261
Lime Tree, 166
Linden, 80, 82, 167
—, European, 290
— Tea, 166
Linnaean Herbarium, 55
Lipp, Louis, 51
Liquidambar styraciflua, 72, 73
Liriodendron tulipifera, 73
Lobelia Tupa, 211
Locust, 67, 78
Long, C. Robert, 252
Longleat estate, Wiltshire, 184
Longwood Foundation, 258
Lonicera 'Arnold Red', **43**, 51
Lophophora Williamsii, 205
Loudon, John Claudius, 179, 185, 187
LSD, 207
Lycoperdon, 207
Lygodium lanceolatum, 25
Lynde (Linden), 166

Maackia amurensis, 67
Madagascar, 22, 26, 28, 29
—, collecting herbs in, 23–29
Maddox, John, 228
Magnolia, 96, 160, 187, 241
—, Saucer, 90
—, Star, 90, 96
—, Umbrella, 90
—, Yulan, 90
Magnolia acuminata, 90
— *denudata,* 90
— *lobneri* 'Merrill', No. 2 **cover 1**, 51
— *soulangeana,* 90
— *stellata,* 90, 96
— *tripetala,* 90

— *virginiana*, 90
Maguira sclerophylla, 208
Making of a Botanist, The, Gerhard Rehder, 141–156
Malouetia, 213
Malus, 84, see also Apples
— 'Albright', 279
— 'Arctic Red', 279
— *arnoldiana*, 51
— *baccata*, 279
— 'Dolgo', 280
— 'Donald Wyman', 55
— 'Dorothea', 279
— 'Henrietta Crosby', 51
— 'Hopa', 280
— *hupehensis*, 280
— 'Osman', 279
— *pumila medwetzkyana*, 280
— 'Red Flesh', 280
— 'Royalty', 280
— 'Springtime', 279, 280
— 'Sylvanna', 280
Mandakolahy, 27
Manual of Cultivated Trees and Shrubs, Alfred Redher, 51, 258
Manual of Trees of North America, C. S. Sargent, 7, 52, 185
Many-aho, 25
Martinella obovata, 216
Maple, Fullmoon, 70
—, Japanese, 70, 290
—, Norway, 69, 290
—, Paperbark, 290, 291
—, Red, 69
—, Siebold, 70
—, Silver, 69
—, Striped, 70
—, Sugar, 69
—, Sycamore, 70
—, Tatarian, 70
Mapuche Indians, 209
Market, Madagascar, 28
Mascagnia glandulifera, 214
Massachusetts Horticultural Society, 187, 268
May Apple, 115
Mayna, 213
— *amazonica*, 212
— *muricida*, 213
— *toxica*, 213
McDonald, Hazel A., 266
Meconopsis integrifolia, 112
Medicinal plants, 23–29, 198–219
Melia azedarach, 102
Melolontha melolontha, 179
Mendoncia aspera, 213
Mengtsz, China, 104
Menstrual remedy, Madagascar, 27
Mercer, Martha Dana, 19
— Research Fellows, 253, 270
Merrill, Elmer Drew, 5, 12, 15, 19, 52
Mescal bean, 207
Mesny, W., 109
Metasequoia glyptostroboides, 14, 55, 285
5-methoxy-N, 207
Methysticodendron Amesianum, 209
Meyer, Frank, 9
Microstephanus cernaus, 25
Miller, Philip, 184
Mimosa hostilis, 208
Mitskway borrachero, 209
Mockernut, 68
Möler's Deutsche Gärtner-Zeitung, 152
Momiji, bonsai, 247
Morus, 72
Mother's Heart, 45
Mount Auburn Cemetery, 187
Mountain Ash, 68, 79
Muir, John, 6
Mulberry, 72
Museum of Science, Boston, 252
Mushrooms, hallucinogenic, 205
Muskau Park, E. Germany, 141, 142, 155

Naphthaleneacetamide, 129
Naphthaleneacetic acid, 129
1-naphthyl N-methyl carbamate, 129
National Institutes of Health, 219
National Registration Center for Cultivars, 51
National Science Foundation, 55, 262
Naturalist in Western China, A, E. H. Wilson, 112
N-dimethyltryptamine, 207
Nemesia, 220
Nevling, Lorin I., 255, 262

New England Botanical Club, 271
— — Spring Flower Show, 268, 269
News from the Arnold Arboretum, 165
Nezu, bonsai, 240
N, N-dimethyltryptamine, 207
Nosebleed remedy, Madagascar, 25
Notes from the Arnold Arboretum, Weather Station Data, 1971, Alfred J. Fordham, 289
Nyakwana, 207
Nyssa sylvatica, 91

Oak, 187
—, Black, 74
—, English, 74, 183
—, Pin, 75, 89
—, Red, 74, 75
—, White, 74
Oaxaca, 207
Ocimum gratissimum, 27
Ocotea venenosa, 212
Oco-yaje, 211
Olmsted, Frederick Law, 6, 50, 185, 187
— Park District, 253
Ololiuqui, 203, 205
On Collecting Herbs In Madagascar, David Seligson, 23–29
One Hundred Years of Apples, M. B. Hoffman, 126–132
Ormosia macrophylla, 212
Ostrya, 82, 94
Oxydendrum arboreum, 84, 94

Pachistima, 160
Page, Nancy, 252, 253
Pagoda Tree, 67
Palicourea, 213
Panaeolus sphinctrinus, 205
Paricá, 207
Patinoa ichthyotoxica, 213
Paulownia tomentosa, 71
Paxton, Joseph, 187
Pear, 81
Pelargonium, 220
Pernettya, 211
Perry, Lily M., 14, 53
Persimmon, 91, 98–99
— Pudding, 98–99
Petzold, Edward, 144
Peyote, 205
Phellodendron, 66
Philodendron, 212
— *crasspedodremum,* 213
— *dyscarpium,* 216
—, fish poison, 213
Phyllanthus, 25
Physostigmine, 202
Picea, 65
— *yezoensis,* bonsai, 246
Pieris, bonsai, 246
Pieris japonica 'Flamingo', 280
— — 'Valley Rose', 280
Pignut, 68
Pilgrim Fathers, 186
Piment, 25
Pinchot, Gifford, 9
Pine, 64
—, American White, 184
—, Pitch, 64
—, Red, 64
—, Scots, 64
—, Weymouth, 184
—, White, 64
Pinetum, 185
Pinetum Woburnense, 188–189, 190
Pinus, 64
— *parviflora,* bonsai, 244, 246
— *ponderosa* 'Canyon Ferry Dwarf', 281
— *resinosa,* 64
— *rigidus,* 64
— *strobus,* 64, 184
— — 'Fastigiata', 281
— — 'Lenore', 281
— *sylvestris,* 64
— *thunbergii,* bonsai, 246
Piperaceae, 263
Pittosporum, 241
Plantae Papuanae Archiboldianae, E. D. Merrill & L. M. Perry, 53
Plant Records Center, 258
Plant Registrations, Robert S. Hebb, 277–287
Plants and Gardens of South Africa, H. Brian Rycroft, 220–225
Platanus, 72, 73
Plum, Flowering, 282
—, Winter Flowering, bonsai, 246
Plumbago, 220
Podophyllum, 201

— *peltatum,* 115
Pond Cypress, 283, 284
Ponds early spring, No. 3 cover 3
Poplar, Lombardy, 80, 81, 92
—, White, 72, 80
Population-environment crisis, 226–240
Populus alba, 72, 80
— *deltoides,* 81
— *grandidentata,* 80
— *nigra,* 80, 81, 92
— *tremuloides,* 80
Potato blight, Ireland, 230
Pretoria National Botanic Garden, 223
Pride, George, 261
Primula, 113
Princess Tree, 71
Princeton Nurseries, 250
Propagation under polyethylene plastic, 160–164
Protea, 224
Prunus, 84
— *armeniaca* 'Autumn Royal', 282
— — 'Golden Amber', 282
— 'Purple Pony, 282
— 'Thundercloud', 282
Pseudolarix, 285
Pseudotsuga menziesii, 185
— *taxifolia,* 65
Psilocybe, 205
Psilocybine, 205
Psychotria, 213
— *viridis,* 211
Ptelea trifoliata, 66
Pückler, Count Hermann, 141
Puffballs, 207
Purdam, William, 9
Purgatives, Madagascar, 25
Pyrus, 81

Quercus alba, 74
— *palustris,* 75, 89
— *pedunculata,* 183
— *robur,* 74, 183
— *rubra,* 74, 75
— *velutina,* 74
Quince, Flowering, bonsai, 246

Radriaky, 27
Ranales, Woody, 53
Ranunculus ficaria var. *bulbifera,* No. 2 cover 3
Rapé dos Indios, 208
Raup, Hugh, 54
Ravinambatry, 27
Red Bean, 207
Redbud, 91, 97, 187
Rehder, Alfred, 7, 14, 20, 50, 141, 147, 185, 189
—, Anneliese, 153
—, Gerhard, The Making of a Botanist, 141–156
—, Jacob Heinrich, 143, 147
—, Joachim, 143
—, Paul Heinrich, 143
—, Paul Julius, 147
— Bridge, 146
Repton, Humphry, 144, 185
Retiniphyllum concolor, 213
— *discolor,* 213
— *speciosum,* 213
— *truncatum,* 213
Review, Arboriculturists Companion, N. D. G. James, 292
—, Diseases of the Cultivated Plants of the Southwest, Rubert Burley Streets, 293
—, Florida Gardening Month by Month, Nixon Smiley, 139
—, The Great American Forest, Rutherford Platt, 47
—, A Guide to the Wildflowers and Ferns of Kentucky, Mary E. Wharton and Roger W. Barbour, 170
—, Know Your Garden Series, Trees and Shrubs, Richard E. and Charles R. Harrison, 172
—, Making Gifts from Oddments and Outdoor Materials, Betsey B. Creekmore, 169
—, Native Trees of Canada, R. C. Hosie, 294
—, Natural Dyes and Home Dyeing, Rita J. Adrosko, 171
—, New Approaches to Financing Parks and Recreation, Robert M. Artz, Ed., 169
—, North American Apples: Varieties, Rootstocks, Outlook, W. H. Upshall, Ed., 168
—, Outdoor Laboratory. People and Their Environment, Matthew J. Brennan, Ed., 138
—, Plant and Soil Water Relationships: A Modern Synthe-

sis, Paul J. Kramer, 293
—, Plants of Hong Kong, Stella L. Thrower, 168
—, Proven Herbal Remedies, John H. Tobe, 139
—, The Rust Fungi of Cereals, Grasses and Bamboos, George Baker Cummins, 46
—, The Time-Life Encyclopedia of Gardening — Bulbs, James Underwood Crockett, 139
—, Topiary and Ornamental Hedges, Miles Hadfield, 293
—, Vegetable Dyeing, Alma Lesch, 171
—, West Australian Native Plants in Cultivation, A. R. Fairall, 99
—, The White Flower Farm Garden Book, Amos Pettingill, 292
Rhododendron, 113
Rhododendron obtusum var. *kaempferi*, 50
Rice husking, Madagascar, 26, 29
Rivea corymbosa, 203, 205
Robinia, 67, 78
Robinson, John, 50
Roca-Garcia, Helen, 271
—, Arnoldia in the Kitchen, 98, 166
—, Weeds: A Link with the Past, 45, 136
"Rochester" Strain of Lilacs, The, Robert B. Clark, 133–135
Rock, Joseph, 14, 16, 50
Rogers, Mr. and Mrs. Paul, 260, 271
Romba, 27
Rooks, 179
Root inducing substance, 162
Rosa arnoldiana, 51
Rotenone, 202
Rothamsted Experimental Station, 176
Royal Botanic Gardens, Kew, 103 189, 251
Russell, Archibald, 185
—, John, Duke of Bedford, 188
Russet on apples, 127
Russian Olive, 90
Rutin, 201
Ryania, 213
Rycroft, H. Brian, 225
—, Plants and Gardens of South Africa, 220–225

St. Pierre, Martinique, Botanic Garden, 263
Salictrum Woburnense; or a Catalogue of Willows in the Collection of the Duke of Bedford at Woburn Abbey, 188, 190
Salix, 21, 83, 84
Salvia divinorum, 207
Sambucus canadensis, 288
Sanguinary, 45
Sanirana, 25
Saponaria officinalis, 136, 137
Saponin, 136
Sargent, Charles Sprague, No. 1 cover 1, 2, 3–9, 14, 20, 49, 103, 141, 152, 165, 174, 188, 253
—, Henry Winthrop, 187
— Memorial Fund, 10
Sargentia, 52
Sarongazana, 27
Sasa veitchii, bonsai, 245
Sassafras, 73
Sassafras albidum, 73
Sax, Karl, 5, 12, 15, 17, 51, 53
Scald on apples, 131
Schmidt, Johann Julius, 150
Schneider, Camillo, 20, 185
Schoenobiblus peruvianus, 212, 213
Schrefeld, Gustav, 148
—, Johann Gottlieb, 148
Schubert, Bernice G., 52, 265
Schultes, Richard E., 218
—, From Witch Doctor to Modern Medicine. Searching the American Tropics for Potentially New Medicinal Plants, 198–219
Schwarten, Lazella, 54
Scientific Staff of the Arnold Arboretum, 56–58
Scientists and Scientific Contributions of the Arnold Arboretum. The First Century, Richard A. Howard, 49–58
Scoparia dulcis, 25
Seligson, David, On Collecting Herbs in Madagascar, 23–29
Sequoiadendron giganteum, 165,

255, 256, 257
Serruria florida, 221
Sevin, 129
Shadbush, 84
Shepherd's-purse, 44, 45
Siberian Pea Tree, 67
Sigma Xi, 268
Silk Tree, 69, 85
Silva of North America, The, C. S. Sargent, 7, 52, 178, 185, 189
Silverbell, 84, 95
Simple Frame for Softwood Propagation, A, Alfred J. Fordham, 160–164
Smith, Albert C., 52
Smog, London, 228
Smokebush, 91, 97
Soapwort, 136
Softwood cuttings, 161
Solanum nodiflorum, 29
Sophora japonica, 67
— *secundiflora*, 207
Sorbus, 68, 79
Sourwood, 84, 94
Sousa-Sanchez, Mario, 265
South Africa, gardens and plants of, 220–225
Sparaxis, 220
Sprays for apples, 127
Spruce, 65
Staff of the Arnold Arboretum, current, 276
— — — —, past, 56–58
Staphylea, 77
— *trifolia*, 65
Stearn, William T., 191, 268
—, From Medieval Park to Modern Arboretum: The Arnold Arboretum and its Historic Background, 173–197
Stephens, Edith, Cape Flats Wild Flower Reserve, 223
Stern, William L., 263
Stewartia koreana, 264
Strawberries, 272
Strelitzia, 220
Streptocarpus, 220
Streptocarpus rexii, 222
Stropharia, 205
Strouthion, 136
Strychnos, 212
— *spinosa*, 24
Sutton, Stephanne B., 271
—, The Arboretum Administrators: An Opinionated History, 3–20
Sweet Bay, 90
Sweet Gum, 72, 73
Sweet potato farming, Madagascar, 22, 26
Sycamore, 72, 73
Sylva, John Evelyn, 177, 185
Syringa, cultivars, 133–135
— *mandshurica*, 72
— *vulgaris* 'Rochester', 134
Szemao, China, 106

Tabaco del Diablo, 211
Tabernaemontana, 213
Taiwanos Indians, 212
Taro farming, Madagascar, 22, 26
Taxodium, 283–287
— *ascendens*, 283, 284
— — 'Prairie Sentinel', 283, 284
— *distichum*, 283, 285
— — 'Shawnee Brave', 286
— *mucronatum*, 285
Taxus baccata 'Davie', 283
Tea, wild, 113
Tecomaria, 220
Teonanacatl, 205
Tetrapteris, 214
— *methystica*, 210
— *mucronata*, 210
Thayer Hall, planting, 254
Themeda triandra, 25
Thistleton-Dyer, Sir William, 103
Thlaspi, 45
Thunberg, Karl, 241
Thuja, 65
Tikunas Indians, 213
Tilia, 80, 82, 167
— *europaea*, 290
Tilleul, 166
Tilo, 167
Tinie Versfeld Wild Flower Reserve, 223
Toddalia asiatica, 27
Tomlinson, P. Barry, 268
Tonga, 27
Toothache remedy, Madagascar, 25
Treatise on the Theory and Practice of Landscape Gardening, Andrew Jackson Downing, 187

Tree of Heaven, 67, 78
Trees for American Gardens, Donald Wyman, 51
Trees of city, identification, 59–97
Trees of Great Britain and Ireland, The, H. J. Elwes and A. Henry, 185, 189
Trichocereus Pachanoi, 211
Triumfetta bartramia, 27
Tryptamines, 207
Tsiktolito, 25
Tsimahavano, 25
Tsinga fiafi, 27
Tsotsorini-hangatra, 25
Tsuga, 65, 76
— *canadensis* 'Narragansett', 287
Tsy maky asotry, 25
Tucker, Ethelyn, 54
Tulip Poplar, 73
Tulip-tree, 187
Tupa, 211

Ulmus, 81, 82
Umbiasha, 24
Ume, bonsai, 246
Unonopsis veneficiorum, 212
Urena lobata, 27
Urinary infection remedy, Madagascar, 27
Urospatha antisyleptica, 216

Vaccinium vitis-idaea, bonsai, 245
Vahona, 25
Vaux, Calvert, 185
Veitch, James, 103
Venturia inaequalis, 127
Veratrum viridis, 201
Vermeulen, John and Sons, 271
Vernonia, 25
Viburnum, 140, 160
—, Siebold, 71
Viburnum sieboldii, 71
Vilca, 208
de Vilmorin, Maurice, 103
Vining, Donald, 269
Vinho de jurema, 208
Virola, 207, 208, 212
— *calophylla*, 207
— *calophylloidea*, 207
— *carinata*, 216
— *flexuosa*, 216
— *Schultesii*, 216
— *Surinamensis*, 216
— *theiodora*, 199, 206, 207
Voamponina, 24
Voakaiepoka, 29
Vochysia ferruginea, 212

Wacker, John, 261
Wadleigh, Jeanne S., 271
Wafer Ash, 66
Waika Indian extracting resin from *Virola theiodora*, 206
Waldenburg, Park and Gardens, 149, 150
Walnut, 68
—, Black, 68
Washington, George, 187
Watson, William, 179
Weather Station Data 1971, Alfred J. Fordham, 289
Weaver, Richard, E., #6 cover 1, 253
—, A Guide to City Trees in The Boston Area, 59–97
Wechsler, Mrs. Paul, 252, 260
Weeds: A Link with the Past, Helen Roca-Garcia, 45, 136
Weigela, 160
Wetmore, Ralph, 263
WGBH Crew at Arboretum, 266, 267
Willow, 21, 83, 84
Wilson, Ernest H., 7, 11, 14, 20, 50, 103, 189
Wilson's First Trip to China, William Gardener, 103–113
Winter jasmine, bonsai, 246
Witch Hazel, 81, 82
Woburn Abbey, Bedfordshire Arboretum, 188
Wodeneth, 187
Wood, Carroll E., 52, 252
Wood collection, 263
Woodlands, England 16th and 17th centuries, 176
Worcester County Horticultural Society, 268
Wound remedies, Madagascar, 25
Wünsche, Otto, 151
Wyman, Donald, 14, 51, 165, 253
—, Arnold Arboretum Plant Introductions: The Second Fifty Years, 1923–1972, 30–43

Wyman's Garden Encyclopedia, 51

Yaje, 205, 210
Yakee, 207
Yellow-wood, 67
Yew, English, 283
Yopo, 205, 208
Yunnan, China, 106

Zelkova serrata, bonsai, 247
Ziegenfuss, Layne, 271

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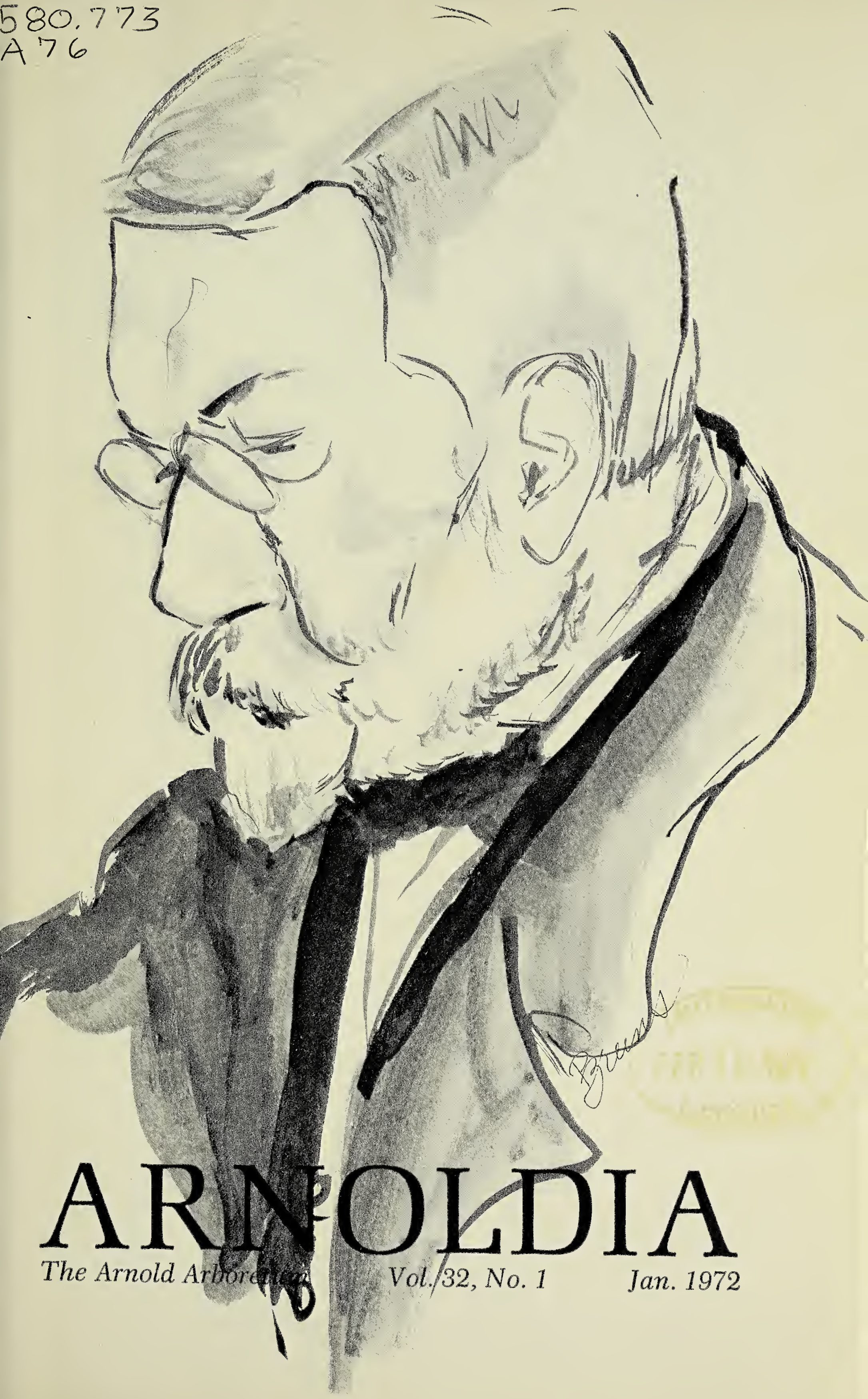

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The Arnold Arboretum Vol. 32, No. 1 Jan. 1972

Contents

3 The Arboretum Administrators
S. B. Sutton

23 On Collecting Herbs in Madagascar
David Seligson

30 Arnold Arboretum Plant Introductions: The Second Fifty Years
Donald Wyman

45 Weeds: A Link with the Past
4. Shepherd's Purse
Helen Roca-Garcia

46 Arnold Reviews

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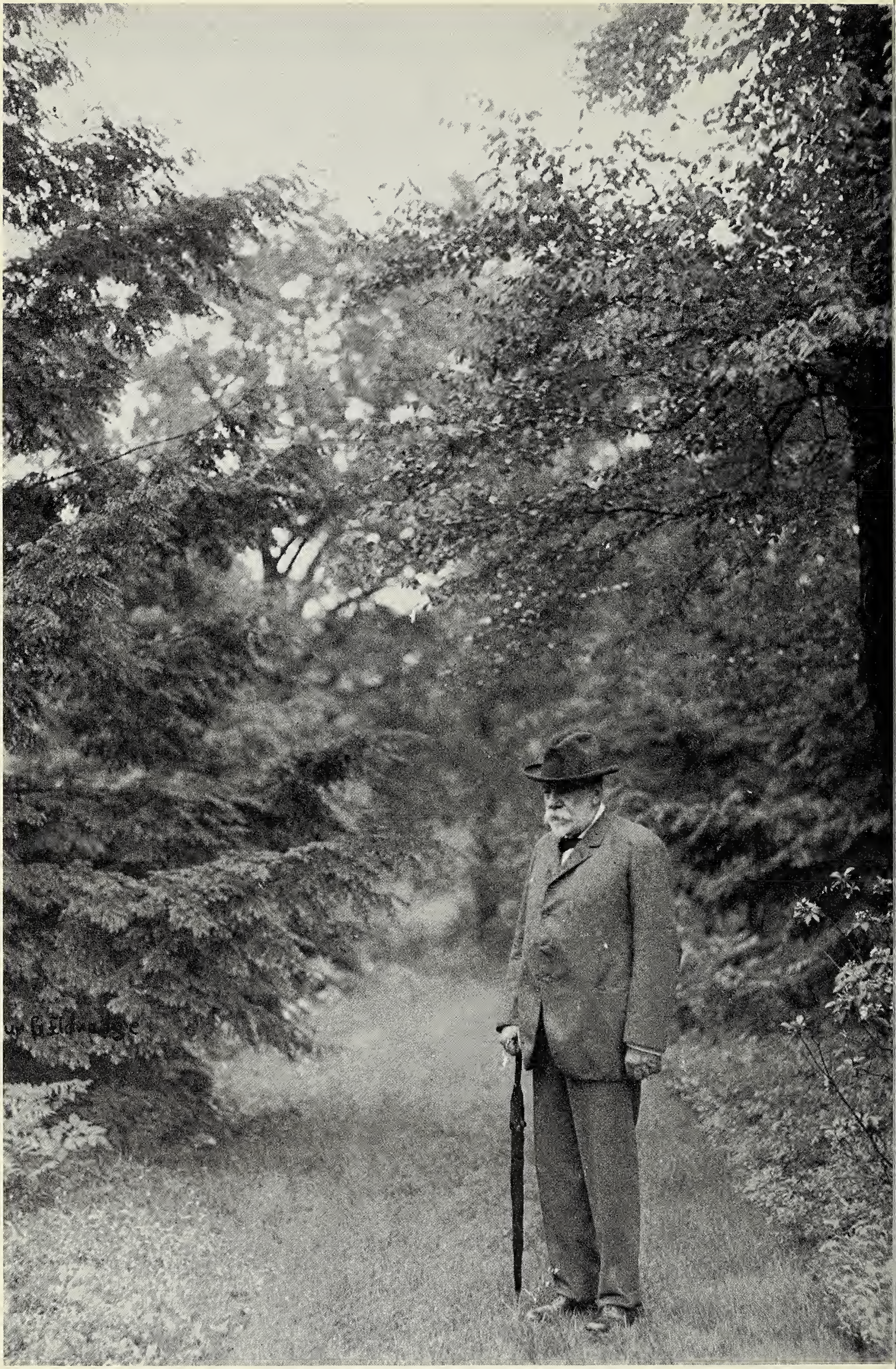
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The Arboretum Administrators:

An Opinionated History

[The author of this article has been associated with the Arnold Arboretum since 1963. For two years she was secretary to the present Director; for four years she worked on a biography of the first Director; on other occasions she has scrutinized Arboretum history more closely than most. The administration of the Arnold Arboretum, to which this paper is largely addressed, has long interested her. However, she confesses that her association with Dr. Howard and her prolonged study of Sargent have influenced her views. She does not believe that purely "objective" history is worth much or, for that matter, that another person would necessarily produce a less opinionated discussion of this topic. Nevertheless, she feels it only fair to warn readers of her prejudices.]

Charles Sargent was a despot. Though it is currently unfashionable to praise despotism — and the author instinctively mistrusts tyranny in any form — both the historical record and the existing Arnold Arboretum justify, in retrospect, Sargent's brand of directorship. With the advantage of hindsight, one even suspects that the aggressive exercise of power was the only solution to the administrative problems that faced him when the Harvard Corporation appointed him to his post in 1873. He did not make a conscious decision for absolutism; to assume authority came naturally to him. He was a Boston Sargent, and Boston Sargents were traditionally willful people, in public service or the professions, as artists or merchants. One senses authority in the gallery of family portraits reproduced in the Sargent genealogy as one senses it in the gruff likenesses of Charles Sargent which, for better or for worse — but surely for posterity — adorn the Arboretum Administration Building in Jamaica Plain.

Sargent confronted a desperate situation: 125 acres of what he called "worn-out farm" and an available income of less than

harles Sprague Sargent circa 1907.

James Arnold

$3,000 per year from the James Arnold estate with which to convert it into an arboretum. His grasp of the notion of "arboretum" was, at best, vague, and he had no formal training in either horticulture or the botanical sciences. He came to the Arnold Arboretum, on the strength of family reputation and social connections, as a man with an unremarkable record of dalliance. Looking for early evidence of aptitude for his career at Harvard, one notes only that he had managed his father's Brookline estate quite nicely for a few years. It would appear, therefore, that the Harvard Corporation did not consider either the Arnold Arboretum or its directorship very important.

Sargent's dynamic administration made them change their minds. Under his rule — which lasted more than half the century being celebrated this year — the worn out farm grew into a handsome botanical garden; a scientific program developed, and the library and herbarium were amassed to support it; explorers collected new plants in exotic places; the endowment increased to perpetuate the institution and its work *ad infinitum*. By the time Sargent died, in 1927, the Arnold Arboretum had an international reputation as a place of scenic beauty and as a leader in the plant sciences.

Four men have administered the Arnold Arboretum since Sargent: Oakes Ames (1927–1935), Elmer Drew Merrill (1935–1946), Karl Sax (1946–1954), and Richard A. Howard (1954–). Like Sargent, each one has left his mark, by default or design, and some have been better administrators than others. They have differed in personality, style, background, physique, and scientific orientation. In fact, aside from their involvement with the Arboretum, no one characteristic is common to all of them. Their collective recommendations and decisions are responsible for the institution as it is today: the garden at Jamaica Plain, the expanded physical facilities in Weston and Cambridge, the research collections, the publications, and the scientific program.

Sargent: Benevolent Despot

No one can deny that the Arnold Arboretum is, above all, Sargent's creation. He was, as observed earlier, an autocrat, a man of financial substance from the top of the social heap. Though the United States had no royalty — and Sargent himself thought kings and queens frilly excesses — the so-called Boston Brahmins lived very regally indeed. Sargent's household servants dressed in livery; Sargent took a dim view of universal sufferage and graduated taxation. He did not possess a democratic soul. He was haughty, stern, abrupt, stubborn, and sometimes tactless; he was also strong, clever, relentless, a good judge of men, and wealthy. What he lacked in scientific experience at the beginning of his career, he compensated for with administrative imagination and money.

Though the original situation — the neglected farmland and the insignificant funds — had nightmarish aspects, Sargent had one colossal advantage over every other administrator who followed him: he started from scratch. He did not owe obeisance to traditions and he was not bound by others' decisions. It was for him to interpret the meaning of "arboretum," only barely outlined in the indenture between Arnold's trustees and Harvard University, and to define the scope of its work. In the initial throes of enthusiasm, Sargent made grandiose plans: impractical planting schemes, forestry plots, an elaborate indoor museum. But nature, experience, and advice — some of which, one notes, he had the wisdom to accept — effectively prevented him from over-committing himself. He altered his proposed planting pattern to conform with ecological necessities instead of textbooks; he gave up his forestry plot altogether; he drew realistic perimeters around his idea of a museum. He was fortunate to be able to draw on the opinions of great men: Asa Gray, Sir Joseph Hooker, F. L. Olmsted, John Muir, and others.

Sargent refused to permit institutional poverty to obstruct the growth of the Arboretum. In this respect, his personal fortune and social status were indispensable. What the Arnold income could not pay for, Sargent covered out of his own pocket or begged from his friends. When Olmsted's firm had to be paid for preparing landscape plans, Sargent raised $2,000 in less than twenty-four hours. For decades he authorized expenditures of several thousands of dollars beyond the budget and solicited donations from Boston society to balance his books. For example, a $30,000 gift from Horatio Hollis Hunnewell built the main section of the Administration Building in Jamaica Plain in 1892. Furthermore, in addition to meeting his immediate needs, Sargent collected funds for the endowment to secure a financial footing for the future. By contemporary standards his patrons were few in number but exceptionally generous with their checkbooks. The Director, appreciative of their confidence, rewarded them with results at the Arboretum, gifts of rare plants, and personal attention.

One of the by-products of Sargent's skillful fund raising was that it won him leverage within the University. Had he not demonstrated his considerable financial talents early in his administration, it is unlikely that the Harvard Corporation would have permitted him to negotiate with the City of Boston to share in the Arboretum venture. As it was, most University officials were lukewarm to the idea, and President Charles Eliot was downright hostile to it. Yet this was undoubtedly Sargent's most significant decision, and he and Olmsted fought fiercely for public and political support of their scheme. Thanks to the 1882 agreement between Harvard and the City (by which the City took over ownership of the land, leasing it back to the University for a dollar per year, and contracted to build and maintain the roads, provide a water supply and police protection in exchange for use of the Arboretum as a free public park), the Arboretum was masterfully landscaped by Olmsted and was able to develop on a much greater scale than it could have achieved as a private university botanical garden.

Administration Building, 1890. Photo by Boston Park Commission.

The combination of financial backing, the contract with the City, and geographic alienation from Cambridge made Sargent more independent of Harvard than any of his successors; and because the Arboretum was, so to speak, his baby, he oversaw its development with a thoroughness that no subsequent administrator duplicated. He made daily tours of the grounds, supervised the growth of the library and herbarium, carried on voluminous correspondence, checked on seedlings in the greenhouse, and controlled every penny of income and expenditure. He assembled a superior staff (Alfred Rehder, C. E. Faxon, Jackson Dawson, and E. H. Wilson were its prominent members) as much by luck as by good judgment. He treated them with feudal deference, remaining socially and personally aloof; but he was quick to delegate responsibility to those who could handle it and credit to those who deserved it. Though dreadfully underpaid, the staff were fiercely loyal to him and the Arboretum, perhaps inspired by his dedication and by the certainty that he would come to their aid in a crisis.

Despite his administrative load and nagging physical ailments, Sargent produced his report on forest trees of North America for the 1880 Census, the classic fourteen volume *Silva*, the more compact *Manual*, and many short botanical works.

Oakes Ames

He crusaded for national park legislation and he travelled extensively in North America and throughout the world. He began every manuscript or trip with the Arboretum in mind and, indeed, his individual efforts contributed significantly to the institution's reputation. He seemed never to stop working and did not differentiate among weekdays, weekends, and holidays. In the process, he shortchanged his personal life, as have many other ambitious, vigorous men.

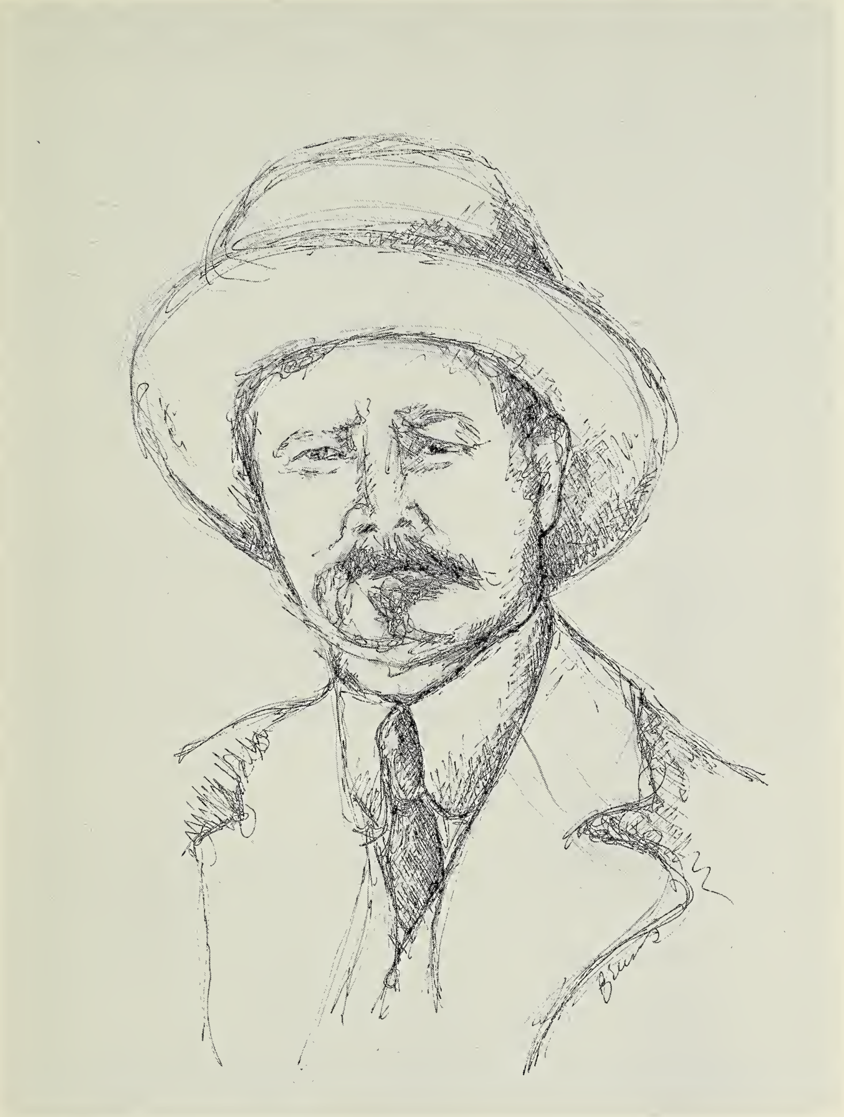
Sargent lived until 1927 and retained the post of Director until his dying day. He had, therefore, a chance which arrives to few men: to manipulate his dream for a long time and to watch it mature. He also had more time to make mistakes, but they were surprisingly few. He blundered into naming hundreds of species in the genus *Crataegus* and planting the whole Peters' Hill tract with the troublesome creatures. He stubbornly insisted — for what reason I cannot fathom — that a particular mountain in northeastern China supported a rich ligneous flora and wasted Arboretum money and the time of two explorers (Frank Meyer and William Purdom) to have it investigated. In a foul-tempered spat with federal authorities, he cancelled the Arboretum plant introduction program during the early 1920s. He argued needlessly with Gifford Pinchot over national forest policy. But none of Sargent's mistakes did serious damage to the Arboretum. If one wishes to criticize Sargent as an administrator, one might say that his intensely personal, autocratic, and independent directorship unwittingly created problems for his followers. Yet it is difficult to imagine that more could have been accomplished for the Arboretum by either another man or another style of leadership.

Ames: Remote Control

Nothing demonstrates the absolutism of Sargent's office more dramatically than the panic that seized the Arboretum staff after his death. Rehder believed a rumor that all scientific work would be abandoned and that the grounds would remain open as a park. Wilson, who had been Assistant Director since 1919 and was in temporary command, was equally apprehensive and took immediate steps to cut back expenses. So closely had the Arboretum been identified with a single man that it seemed as though the one could not survive without the other. But the doubters sold Sargent short. He had planned for the future all along.

Sargent's sovereignty had long been a thorn in Harvard's side, but during his lifetime the Corporation had not mounted a real challenge to it. With his death, however, they determined to draw the Arboretum closer and to coordinate its activities with other botanical branches of the University. It was hoped that, under an administrative umbrella, a spirit of cooperation would supplant the traditional competition which existed among the Arboretum, the Harvard Botanic Garden, the Botanical Museum, etc., and that the costly habit of duplicating facilities and materials could be brought to a halt. The Corporation, therefore, created a council of the directors and curators of all the botanical collections. At its head, with the awesome charge of creating harmony, was an old friend of Sargent and another Boston Brahmin, Professor Oakes Ames. Ames was also delegated as "Supervisor" of the Arnold Arboretum, of the Atkins Garden in Soledad, Cuba (over 200 acres of land donated to Harvard in 1926 and administered by the Arboretum until 1945), and of the Botanical Museum.

Ames' administration proved to be precisely the opposite of Sargent's: impersonal and brief. Ames was the consummate gentleman — impeccably mannered, tactful, and articulate. He had been cast in the role of diplomat rather than leader, and he appears to have accepted the part reluctantly, out of a sense of duty to Harvard. A skilled orchidologist and a teaching professor of economic botany, he had been Curator of the Botanical Museum. Given a multitude of responsibilities, it is obvious why Ames could not indulge the Arnold Arboretum with Sargent-like concentration. He kept his office in Cambridge and had his chauffeur drive him out to Jamaica Plain once a week for a tour of the grounds and a chat with the staff. Meanwhile Wilson — who had aspired to the directorship but, lacking executive experience and proper connections, probably would have made a terrible director — made the day-to-day decisions, much as he had during Sargent's waning years. He asked for, and received, the title of "Keeper," which soothed his ruffled fur and, incidentally, carried a good deal of weight in his native England where many people supposed he was the director — a misunderstanding which he took no pains to rectify. Ames' weekly visitations at first troubled the staff, but their work continued smoothly and they learned to appreciate his integrity and his distant rule. After Wilson's death in an automobile accident in 1930, Ames distributed the everyday responsibilities at random among the staff, and routines established by Sargent perpetuated themselves. A campaign to fatten the endowment progressed nicely under the billing of a Sargent Memorial Fund, defending the Arboretum against the early Depression.



Ernest A. Wilson
Pen and Ink Sketch by P. Bruns.

If Ames' divided loyalties deprived the Arboretum of his complete attention, his broad appreciation of botany widened the scope of the institution's research. Under Sargent, a resolutely nineteenth century figure, the staff had concentrated on taxonomy and horticulture. Ames encouraged a closer relationship with the adjoining Bussey Institution (of which Sargent had been unreasonably contemptuous) which carried on research in experimental breeding and plant diseases. He brought in J. H. Faull, a pathologist; I. W. Bailey, a specialist in wood anatomy; Karl Sax, a geneticist and plant breeder. All of these men became eminent in their fields and represented the Arboretum's commitment to modern, as well as classical, botany.

The task of following Sargent would have been difficult under any circumstances; under the conditions which the Harvard Corporation set for Ames, it was impossible. He intelligently made no pretense of replacing Sargent. He governed quietly from afar, watching the budget and permitting the staff to follow their inclinations within financial reason. His heart, however, was in the Botanical Museum, orchids, and his own research. The power which an ambitious man might have wrested from his multiple posts did not tempt him. He was, above all, a scholar and a gentleman. In 1935, having discharged his obligations for eight years, he resigned in favor of his work and the Botanical Museum, of which he eventually became Director.

Merrill: Tiny Dynamo

Ames' mantle fell to sixty-year-old Elmer Drew Merrill who came to Harvard from the New York Botanical Garden where he had succeeded Nathaniel Lord Britton — an administrator of much the same style as Sargent — as Director. Unlike Sargent and Ames, Merrill was neither socially prominent nor wealthy. He was, rather, an unusually talented research taxonomist who had coupled a career in science with one in administration. For twenty-two years, between 1902 and 1924, he worked as a botanist in the Philippines with the Insular Bureau of Forestry; he eventually became head of the Department of Botany at the University of the Philippines. While undertaking his comprehensive study of the local flora he initiated and oversaw the development of the herbarium and library for the Bureau of Forestry. (They were, unfortunately, demolished by Japanese bombs during the Second World War.) He accomplished more for Philippine botany, both administratively and scientifically, than any individual had done before or has done since. From the Philippines he moved to the position of dean of the College of Agriculture at the University of California, accepting a simultaneous appointment as Director of the Agriculture Experiment Station. He went to New York in 1929. Often faced with complicated problems, he had a record as an energetic and imaginative administrator.

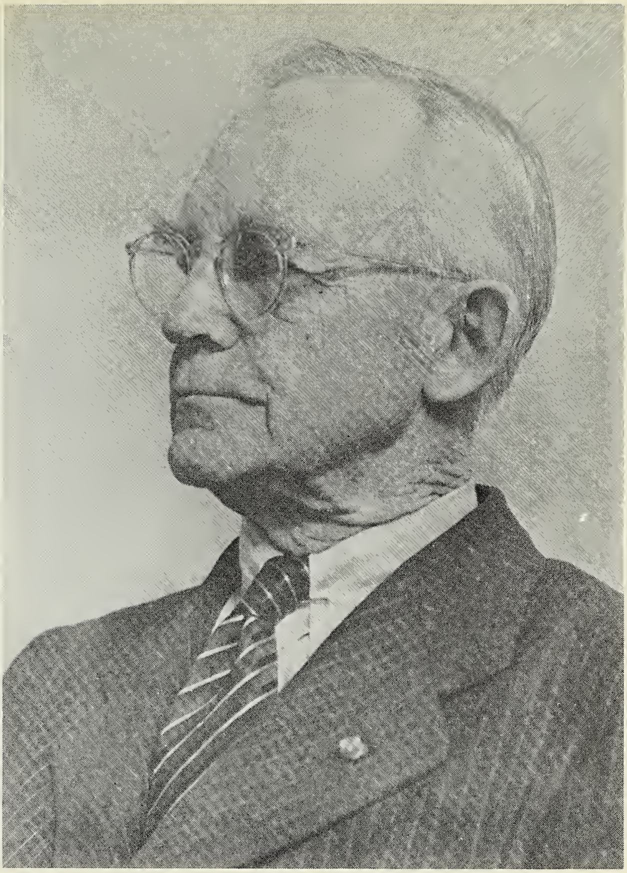
Merrill was one of the most able botanists ever to have been associated with the Arnold Arboretum, but he was not a man for whom scholarly research sufficed. It is clear from the course of his career that he voluntarily committed himself to tasks of increasing executive complexity, that he enjoyed power and institution-building. He was known to complain that administration interfered with his research but, like Sargent, he was a prodigious worker. He hired assistants to carry on the bulk of his studies but tried to find a few hours each day or on weekends to relax with botany. Harvard, theoretically, provided him with a balanced intellectual diet: a heavy administrative load and, at the Arboretum, an herbarium rich in Asian species.

Still intent on a coordinated botanical program within the University, the Corporation appointed Merrill as "Administrator of botanical collections." This was an upgraded version of the post Ames had held and placed Merrill more or less in control of nine separately endowed botanical agencies; of these nine, however, he was only directly responsible, as Supervisor, for two: the Arnold Arboretum and its adjunct, the Atkins Garden in Cuba. Mindful of his duties to the University, Merrill and a committee formalized a plan to consolidate the research holdings in biology under one roof in Cambridge. Wartime tabled the proposal, but it was eventually resurrected in a slightly different form which was to cause considerable commotion in Arboretum history.

Merrill was a wiry, pint-sized man, around 5′2″, the product of a spartan Maine boyhood. He was meticulous, quick, decisive, and active. He believed, religiously, in hard work. During his first year at Harvard he kept his office in the Gray Herbarium on Garden Street in Cambridge. But, because his direct responsibility was the Arboretum and because the research collections which concerned him were there, he moved his headquarters to Jamaica Plain. (No doubt his propensity for quarreling with Merritt L. Fernald, the equally small and explosive man who headed the Gray Herbarium, also prompted his decision to transfer.) The Arboretum staff regarded Merrill with mixed feelings, and one notes that those people who worked closest to him appreciated him most. His energy was an object of universal admiration; the herbarium botanists admired his knowledge of Asian botany. His research assistant, Dr. Lily Perry — who pursues her studies today in the Harvard University Herbaria — found working under his supervision an exhilarating, though demanding, experience. One remarks Merrill's acts of consideration. For example, he contrived to keep Rehder on the staff, with pay, long after his retirement age because he knew that Rehder's resources had been limited by long years at low pay and Harvard, as yet, had no pension plan. An orderly man, Merrill administered with an eye to detail and suffered no wastefulness or frivolity from his staff.

Merrill was not particularly interested in horticulture, and his response to the problem of caring for the grounds was to hire the first Arboretum Horticulturist in the person of young Donald Wyman. Unforeseen disasters complicated a situation which might, under ordinary circumstances, have been satisfactory. A hurricane in 1938 did serious damage to the plantings, and wartime created a shortage of labor and materials which affected their maintenance. Merrill, meanwhile, was engaged in building up the herbarium and library. The Arboretum supported native botanists all over Asia with small grants to collect specimens and seeds, the arrival thereof entailing additional expenditures in Jamaica Plain. While this program followed traditions set by Sargent, rounded out the collections of Sargent, Wilson, Joseph Rock, J. G. Jack, *et al*, enriched the Arboretum's research holdings, and produced seeds of *Metasequoia glyptostroboides*, the living collections needed attention which they did not receive. Merrill seldom toured the grounds, and his relative disinterest in things horticultural was reflected in his annual budget, thus making Wyman's job difficult.

While permitting things to lapse outdoors at Jamaica Plain, Merrill was instrumental in acquiring the Case Estates in Weston as a much-needed addition to the Arboretum. He had the confidence of the Case sisters, Louisa and Marian, and the foresight to realize how the land they offered could be used to expand the experimental breeding and horticultural programs. He persuaded the University officials to accept the terms of their bequests. During the otherwise gloomy war years, therefore, the Arboretum acquired two adjoining plots of land, accompanying buildings, and an endowment of $200,000, additions which have become more useful each year.



Elmer D. Merrill

Karl Sax

Joseph F. Rock

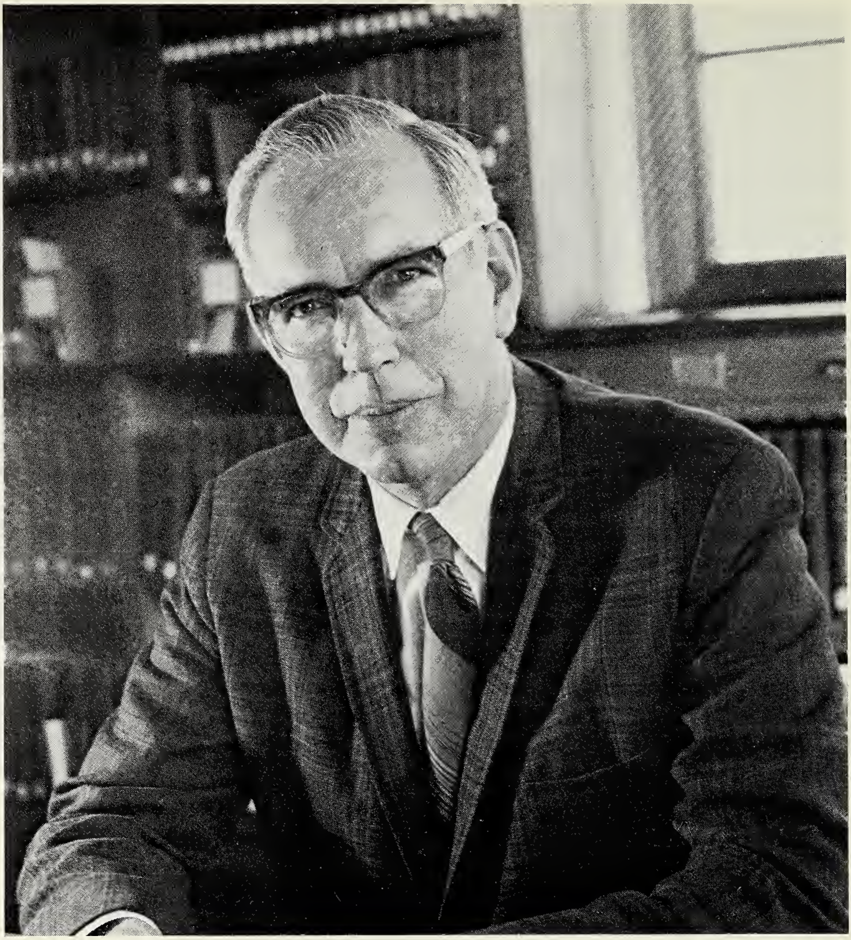
In Tibetan Dress

Merrill retired from active duty at Harvard and administrative life altogether in 1946 at the age of seventy, retaining enough vitality to continue his research work until 1954. The Arboretum which he left behind was richer in almost every respect than the one he had found: there was new land in Weston; the herbarium had increased by more than fifty percent; the library was greatly enlarged; the endowment, though hurt by the war, had made progress; the scientific reputation had been enhanced by staff publications, many of them by Merrill himself, or "Merrill and Perry." But growth aggravated problems, many of them not necessarily of Merrill's making. In fact, the most urgent problem, that of interior space, had been apparent to Sargent in 1922. Merrill's zealous accumulation of resources, however, had brought the Administration Building in Jamaica Plain to the bulging point and forced the issue. Shortly before his retirement, he approved a report, similar to the pre-war plan, recommending the construction in Cambridge of a new building to house the herbarium and library collections of several botanical agencies at Harvard. This was nearly Merrill's last, and certainly his most important, administrative act.

Sax: Troubled Times

Arboretum leadership then fell to Karl Sax whose administration was, in many respects, the most troubled of all. He inherited the combined problems of previous administrations and little latitude to cope with them. He was hampered by traditions and existing conditions. Critical decisions for the future had already been made by Merrill. Even with his title of Director, Sax found himself in limbo. A soft-spoken, handsome man of few words, he appears to have been shy of administrative power, more involved in plant-breeding, cytology and, later, non-botanical research on population, than in his executive role. His inclination was to let the individuals on the staff proceed with their work; he made no effort to establish a coordinated program. Unlike Merrill, Sax was not very impressed with the herbarium. He was prone to wry, disparaging remarks about taxonomists which, though intended in jest, were collectively discouraging. He did not, however, meddle in their work, a fact which they appreciated. He turned his attention to the neglected grounds — much to the satisfaction of the Horticulturist, the Superintendent, and the Propagator — in an effort to restore their elegance. Among other things, he finally got rid of Sargent's unsightly *Crataegus* collection on Peters' Hill.

The construction of the new building in Cambridge awaited the lifting of wartime restrictions, and it was not until near the end of Sax's appointment that it got under way. As the deadline for a new internal order approached, however, the staff began to exhibit signs of anxiety over the future. Having declined an authoritarian role early in his administration, Sax was unable to deal with organizational dissent. A period followed which can best, and most tactfully, be described as one of confusion, both for the Arboretum and for its chief executive. Shortly before the building was completed, the Corporation, eager to see the transition accomplished smoothly, looked for a man of energy and purposefulness who could implement the move. Sax resigned. The Corporation appointed Richard A. Howard Director and Arnold Professor of Botany.



Richard A. Howard

Howard: Economy Size Energy

Howard had headaches from the beginning. First of all, the doorways and stairwells in Jamaica Plain had never been constructed for the convenience of his 6′5″ frame, and he spent a week or more banging his head on hard surfaces before he conditioned himself to duck. Secondly, he had been charged with guiding the Arnold Arboretum through a period of drastic change and he entered into an atmosphere that was already charged with tension. The physical relocation of books, specimens, and personnel to Cambridge was, in itself, a challenge, but one that could be met with hard labor and transportation.

More problematical was that, in an attempt to restore the traditional form, a group of individuals — from both within and without the Arboretum — associated to bring suit against Harvard University. Howard, as the man who executed the move to Cambridge, became the target of personal attacks.

Howard, luckily, possesses stamina, integrity, and a sense of humor; the Arboretum — thanks largely to posterity-minded Sargent — had more flexibility than most people imagined. Both weathered what is now popularly known as the "Arboretum controversy." Due to legal complexities and local political changes, the lawsuit was not settled until 1966, when the Supreme Judicial Court of Massachusetts handed down a verdict favoring Harvard, thereby confirming the legality of the transferral of a portion of the Arboretum staff and research holdings to the Harvard University Herbaria in Cambridge. After almost twenty years, it has become evident that the Arboretum, both as a scientific organization and as a garden of beauty, can operate within the altered framework. Its success as an expanded institution, in three physical locations (including Weston), is largely Howard's product. He can now get on with the business of running the Arboretum in relative peace.

Howard's administration resembles Sargent's in some ways. Like Sargent, he has had many years in office — though he has some way to go to equal the old man's record — and, also like Sargent, he confronted a new situation and had the character and means to cope with it. Although geographic dislocation, a large staff, bigger herbaria and library, etc., make for a more cumbersome organization than the original, Howard attempts to distribute his time — and the Arboretum budget — impartially. He has recognized, perhaps better than any administrator since 1927, that the appearance of the grounds counts heavily with the public and, with the help of a generous bequest from Mrs. Martha Dana Mercer, has made improvements in the living collections and propagating facilities.

Times, of course, have changed and, though he may occasionally envy Sargent's lot, Howard is no despot. He concerns himself with everything from mops to new plantings on the Case Estates. He feels, unlike many administrators, that it is his duty to deal with irritating decisions on all levels so that his staff remains free to pursue their botanical and horticultural research. He is a skilled taxonomist, and his own program of investigation of the flora of the West Indies suffers, but not as much as it would did he not, like Sargent and Merrill, work long hours and on weekends. His staff regards him with a mixture of wonder and weariness, asking where he gets his energy. He usually seems to be flying from one place to the next and he is hard to pin down.

Howard has the disease of all directors: the endowment. It has grown substantially from the Arboretum's inception, but the institution is bigger and prices have risen. A new century begins this year, and Howard knows there is growth ahead as well as existing programs to support. He would like to provide for the future, to retire one day from a much greater organization than he found. Howard's administration is not over yet. History will have another crack at him.

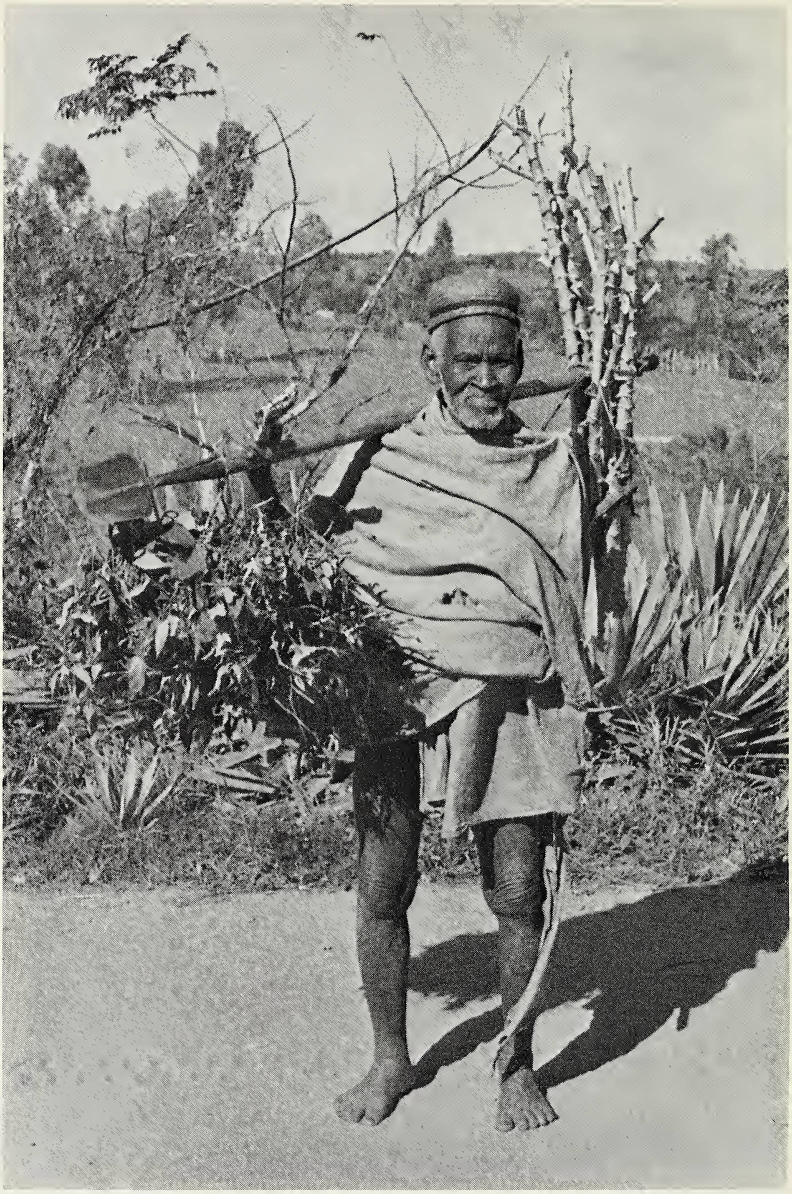
S. B. SUTTON

There has been no attempt to provide biographical background in this article. Those interested in additional information should consult:

Sutton, S. B., *Charles Sprague Sargent and the Arnold Arboretum.* Cambridge, Mass.: The Harvard University Press, 1970.
Sargent, C. S., "The First Fifty Years of the Arnold Arboretum," *JAA* III: 127–171, January 1922.
Sax, Karl, "Oakes Ames," *JAA* XXXI: 335–349, October 1950.
Howard, Richard A., "Elmer Drew Merrill," *JAA* XXXVII: 197–216, July 1956.

Salix spp. *in winter at the Arnold Arboretum.*
Photo by P. Bruns

Left to right: Alfred Rehder, E. H. Wilson, C. S. Sargent, C. E. Faxon, Camillo Schneider.



A farmer on his way to the field with cuttings of taro and sweet potatoes for the day's planting.

On Collecting Herbs In Madagascar

Atanoushi, the Province of Fort Dauphin, in southeast Madagascar, is a patchwork of humid groves and dry scrub sequestered from the rest of the Island by a range of encircling mountains on the north and opening on the south on the Indian Ocean. This geographic situation first invited colonization by the French, and now isolates a colorful and somewhat inscrutable citizenry from whatever Europeanizing influences emanate from the capital in the north. In the approximately three hundred years since Etienne de Flacourt complained about the Malagasy, little has changed:

> S'il y a nation au monde adonnee a la trahifon, diffimulation flatterie, cruaute, mefonge & tromperie, c'eft cell cy. . . .
>
> Flacourt, p. 83.*

The physician in search of useful plants in Southeastern Madagascar undertakes a tantalizing but frustrating task. In pursuit of a shrub with healing qualities, questioning a curious sign painted on a body or the appearance of a number of feathers near a hospital bed, he finds the answer concealed in a web of evasion which not only protects the native practitioner from expected scorn, but also serves to preserve this folklore from Western influence.

For example, as a clinic physician at the Manabare Lutheran Hospital, I noticed, when examining a pleasant elderly lady with leg pain, numerous elaborate scratchmarks, neatly spaced in groups of five, on her thigh above the lateral cutaneous nerve. On a prior visit, failure to appreciate a common pain syndrome caused the dissatisfied invalid to resort to the local competition. Following precise injection of an instant pain relief to this nerve, I was able to obtain from her the story that the scratches had been made with a sharpened awl dipped in a potion made from certain plants thought to have anaesthetic properties. I was able to obtain a few scraps of leaves and twigs, but requests for flowers or fruits or the plant itself brought only endless smiles, leaving a botanical riddle.

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* Etienne (Stephenne) de Flacourt, (1607–1660), a native of Orleans France, was superintendent or governor of the colony established by the French on Madagascar. Later he became general director of the French East India Company. Although not a naturalist Flacourt observed well and wrote of the "natural productions" of the area. A quarto volume of his observations was published in Paris in 1658. The plant genus *Flacourtia*, type of the plant family Flacourtiaceae, was named in his honor. In fact, *Flacourtia indica*, a tropical fruit, is commonly known as the "Governor's Plum" having been described first by Flacourt.

Rural medicine, as practiced by the *Umbiasha*, or sorcerer, Madagascar's General Practitioner, does not rely on botanicals. The *Umbiasha* performs his spells on talismans — *oodis*-cornicopias stuffed with pebbles, dung, blood — worthy of the Witches' brew in Macbeth. These horns are treasured by the holders as protection against illness, enemies, and the fates. Fortunes are told with the use of the seeds called the Voamponina (probably *Strychnos spinosa*). These seeds are arranged in a series of matrices following an elaborate ritual. Each position in the matrix represents an element of destiny: in the first square, the horizontal positions are labeled man, cattle, and brother earth, and the vertical ones labeled children, illness, wife, and enemies. At one point, I cured the sorcerer's son of a web-space infection of the hand and not too subtly expressed an interest in the ritual. It was then possible to learn my destiny from this impressive ceremony.

Herbs are everywhere in use, but information is difficult for the foreigner to secure because precisely those people with the most knowledge are the least communicative. And how many times previously had I, as an outsider, going from clinic to market, passed by a common-looking hut, unaware that when night falls and there is enough moonlight to promote confidence, the *Umbiasha*'s patients are bartering herds of cattle for remedies more powerful than those in the pharmacopoeia. Casual "promenading" (*sangana-sangana*), the chief recreation in a rural society, provided opportunity to look down and say, "Oh yes, isn't this good for cough?" If one's companion replies, "Certainly, just boil the leaves and stems and drink the brew," the herbal verification has been made. But it takes time, attention, and willingness to seize on even informal situations to verify impressions as to how plants are used. It may be bad manners, when a dinner guest, to leave a home with a handful of uncooked spices from the kitchen, but on the other hand, the Malagasy do not expect Americans to understand their etiquette.

I discovered, while ambling in the market, that the deputy mayor had compiled a list of remedies and recipes, and my local friend (an educated Northerner, a Royal Imerna who speaks fluent French) quickly rendered all this information into French and offered to find some of the things. He shared a mutual interest in the medicinals in use among the heathen Southerners. He has pursued a semi-scientific interest in one concoction, claimed to be an anti-diabetic agent, and has taken samples to the University of Tananarive for analysis. His assistance was invaluable, but it was often difficult to persuade him to pick over a curious supply of leaves drying in front of his informant's hut, for he was more interested in displaying his knowledge of pathology and pharmacology.

The most common remedies encountered are for diarrheal diseases which are frequent in an area where virtually everyone has parasites and sanitary precautions are unknown. Representative remedies are *Kildo* (*Microstephanus cernaus* N.E. Br.) and *Tsy maky asotry* (*Ageratum conyzoides* L.). In each case, leaves and twigs are used to produce a bland infusion which is given to the invalid. Indeed, considering that the chief risk of uncontrolled diarrhea is dehydration, the quantities of sterile bouillon remedies administered often cure these self-limiting diseases. It was also possible to collect purgatives, *Vahona* (*Aloe divaricata* Buger), *Famonto kely* (*Helichrysum* sp.), and an antispasmodic, *Many-aho* (*Scorparia dulcis* L.).

A scrub which is particularly abundant along the roads in Manambaro, *Tsotsorini-hangatra* (*Cassia occidentalis*, L.), is used as a substitute for coffee by roasting and grinding the seeds. The leaves of this plant, as well as those of the climbing fern *Tsiktolito* (*Lygodium lanceolatum*, Dess.), are boiled to produce a cough remedy.

Andrarika (*Themeda triandra* Frosh.) is said to be useful for jaundice, as is *Famonta* (*Vernonia* sp.). The hairy leaves of *Famonta* can be rolled up and tucked into the nostril to stop nosebleeding. Another such topical remedy is *Sanirana* (*Phyllanthus* sp.), the root of which is cooked with a little salt, made into a paste, and stuffed into aching teeth. A remedy with the picturesque name of *Dinga-dinga* (*Pistachia altissima* (DC) B. & H.) is claimed to be an antisyphilitic. The leaves are crushed and placed on the chancre. Here, the remission of the primary symptoms would explain the apparent success of the balm.

A great many crushed botanical preparations are available for wounds. With *Faingalala* (*Borreria verticillata*, G.F.W. Meyer) the essence obtained from ground leaves is used. The bark of *Tsimahavano* (*Erythroxylon* sp.) is thought to be useful for multiple pustules. The cooked leaves of Piment (*Capsicum frutescens*, L.) are used as a pomade on wounds. The fiery fruit

of this plant is more commonly used as a condiment accompanying *Kato-Kato*, a bland and traditional poor-man's dish of meat and manioc. Both *Urena lobata*, L. and *Triumfetta bartramia*, L. are used to dress wounds, as well as to bind small packets, and hence they are both called *Tsinga fiafi*.

An infusion of *Ravinambatry* (*Cajanus cajan*, Millsp.) is prepared for menstrual difficulty, and *Romba* (*Ocimum gratissimum*, L.) is used as an anti-hemorraghic agent following delivery. The description and characteristic odor of this plant correspond to entry number 40 in Flacourt's collection:

> 40 *Rhomba* odorante a grandes fueilles, c'eft une efpece de Menthe franche, que l'on nomme Baume, elle a auec cela vne odeur de girole, & de canelle enfemble, elle vient de deux coudees de haut. p. 129

Tonga (*Catharanthus roseus* (L.) Don), which figures prominently in the modern pharmacy as a chemotherapeutic agent against certain leukemias (Vincristin), was also described by Flacourt:

> 42 *Tongue*, herbe reffemblante au *Saponaris*, qui a la fleur comme celle de Iaffemin, l'vne eft blanche, l'autre eft de couleur de poupre, la racine eft fort amere, de laquelle ifs fe feruent contre le mal de coeur, & eft bonne contre les poifons, elle approche du Vincetoxicon; ou afcelpia, & ne vient pas plus haute. Celle qui a la fleur blanche a plus de vertu. p. 130

My informant, who was collecting great bales of *Catharanthus* for an American drug firm, said it could be used as an infusion for fever with abdominal pain.

Radriaky (*Lantana aculeata*, L.) is used as an infusion for hypertension, and *Fandrotsarana* (*Cynodon dactylon* (L.) Pers.) for urinary infection. Descriptions of this type are too indefinite to be reliable and, further, contain a hint of pseudoscience foreign to such prescriptions as *Fandlikatany* (*Toddalia asiatica* (L.) Lam.) in which a brew is made of the leaves to give troublesome children whose fontenelles are dangerously protuberant. Other such interesting recipes from the Sous-prefect's list, but not collected, are items such as *Sarongazana* and *Mandakolahy*. *Sarongazana* is crushed, the juice warmed in a spoon and poured into the ear for earache. The grated root of *Mandakolahy* is placed on the forehead for relief of headache.

Among the interesting edible herbs and fruits collected are *Hazongalala* (*Canephora madagascariensis*, J. F. Gmel.) whose

Top: Hillside in the valley of Ramanafana with cultivated fields of taro and sweet potatoes.

Center: Inner court at the Manambaso Lutheran Hospital.

Bottom: A clay house in the village of Ejeda. A woman is husking rice.

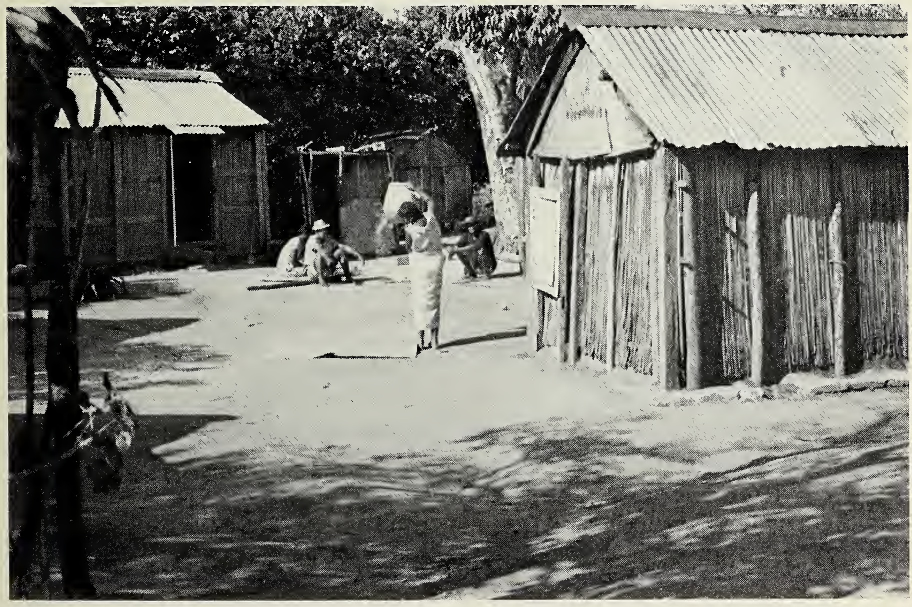
characteristic edible red fruits probably correspond to Flacourt's number 20, *Azonualala,* and *Voakaiepoka* (*Brexia madagascariensis* Thomas) the name of which is onomatopoetic for the sound made when cracking open the hard fruit. Perhaps the most common herbs are *Anamaloho* and *Anabe* (*Solanum nodiflorum,* Jacq.) which are used to season meat and are sold widely in the local markets for a few pennies a handful.

The physician who sojourns in this very different and curious community returns home not only with lists of diseases treated and plants collected, but also with a new perspective — one tinged with the ever-present irony of a scientific man in an anti-scientific setting.

David Seligson

[Dr. David Seligson, as a student in biology at Harvard, began collecting plant specimens for the Arnold Arboretum during his travels. While in medical school at Duke University Dr. Seligson received a Smith, Kline & French Foreign Travel Fellowship which permitted his observations in this paper. Documenting herbarium specimens are in the herbarium of the Arnold Arboretum. Ed.]

The editor is appreciative of the editorial work of Miss Jean Howard in the preparation of this article.



Above: Woman winnowing rice in a family compound.

Left: Fresh eggs and a banana-rice-honey paste wrapped in banana leaves, at Sunday market.

Arnold Arboretum Plant Introductions: The Second Fifty Years

1923-1972

Professor Charles S. Sargent published a list of woody plants in 1922 ("The First Fifty Years of the Arnold Arboretum," Jour. of Arnold Arboretum, Vol. 3, 127–171; 1922) which he thought were first introduced into America by the Arnold Arboretum. Most of these were species and botanical varieties, and the time covered was for the period of the greatest activity in the introduction of plants from the Orient and (in the early part of those first fifty years) from Europe as well. Many of these were the result of special expeditions into the Orient set up by the Arnold Arboretum primarily for the purpose of plant introduction.

The second fifty years has been a period during which many plantsmen throughout the entire United States were introducing plants from all parts of the world. It was impossible to keep track of all this activity accurately. Certain institutions were more active than others, and we have scanned the records of some of these for their specific plant introductions to make certain they did not introduce specific plants prior to the dates in the accompanying list.

The Arnold Arboretum has participated in several expeditions during this period, including Hu's, Rock's, Anderson's and, near the end of the period, several that I made to Europe to introduce new plants found growing in European gardens, nurseries and botanical gardens. The major part of all these introductions have been varieties or cultivars, as contrasted with the species of the first fifty years of introduction. During much of the second fifty years the nursery industry has been at a peak of activity on both sides of the Atlantic and of course it is cultivars that now make up the greater part of "new" plants. Plant hybridizing has also become a very important tool in bringing many of these cultivars into being and into the attention of the public.

The Arboretum has long had a policy of sharing its introductions with other institutions and unfortunately we do not know whether plants which have died for us may have survived in other institutions.

Many of the plants in the following list may not now be alive; all have been brought into America by the Arnold Arboretum for what is thought to be the first time. There undoubtedly still are plants in the following list that have not yet been properly identified, but much has been done to eliminate those that are obviously misnamed or which we have obtained under synonyms. It will also be noted, that with the exception of those that have originated in the Arnold Arboretum, all have been introduced from abroad, and even though some of the cultivars may be of native American species, it is obvious that these could have originated in foreign countries from seed sown in those countries. The following list of plants is merely offered as what we think are first introductions, after we have done considerable checking with our own plant records, with records of other institutions and with information available in our library. If any individual has first hand knowledge that some of these have been introduced into America before the dates herein listed, we will be glad to hear about it and delete them from this list.

Donald Wyman

Plants Introduced by the Arnold Arboretum
1923–1972

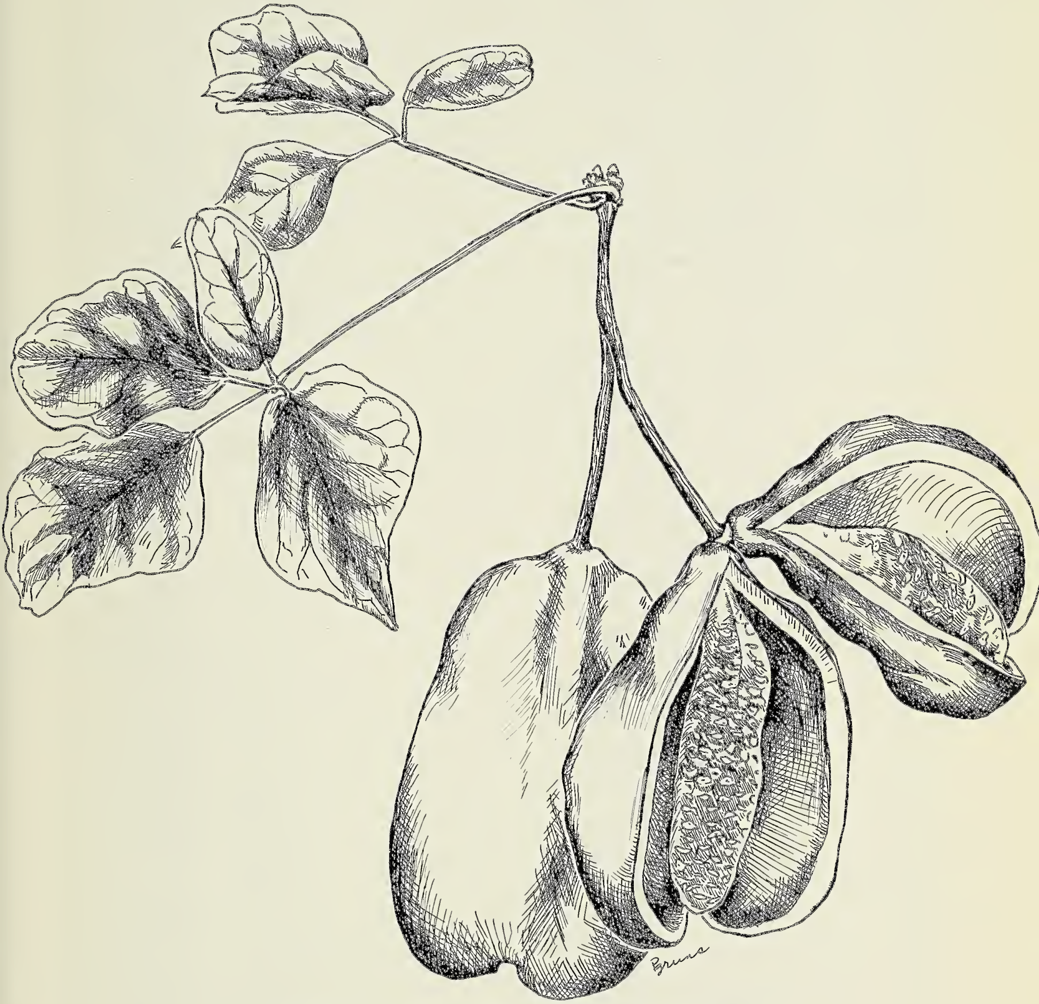
Name	*Record No.*	*Country*	*Year*
Abelia graebneriana 'Vedrariensis'	551–65	England	1965
Abeliophyllum distichum	991–24	Japan	1924
〃 〃 (pink flws.)	477–59	Arn. Arb.	1959
Abies amabilis 'Procumbens'	1043–71	England	1971
Abies balsamea f. *phanerolepsis*	677–67	England	1967
Abies concolor 'Argentea'	622–67	England	1967
〃 *concolor* 'Fastigiata'	975–68	England	1968
〃 *equi-trojani* *	750–65	Turkey	1965
〃 *ernestii*	378–32	China	1932
〃 *magnifica* 'Nana'	986–68	England	1968
〃 *nordmanniana* 'Nana'	985–68	England	1968
Acanthopanax henryi 'Nana'	213–39	Poland	1939
Acer acuminatilobum *	380–60	Hungary	1960
〃 *japonicum 'Vitifolium'*	244–39	England	1939

* These species are not listed in the *Bibliography of Cultivated Trees and Shrubs Hardy in the Cooler Temperate Regions of the Northern Hemisphere* by Alfred Rehder. The Arnold Arboretum of Harvard University, Jamaica Plain, Mass. 1949.

Name	*Record No.*	*Country*	*Year*
Acer mono f. *ambiguum*	715–33	Wales	1933
″ *negundo* 'Aureo-variegatum'	1240–60	England	1960
″ ″ 'Crispum Variegatum'	246–39	England	1939
″ ″ 'Elegantissima'	247–39	England	1939
″ *oliverianum*	759–36	England	1936
″ *opalus* var. *obtusatum*	1758–25	England	1925
″ *palmatum* 'Hagoromokaede'	741–38	England	1938
″ *palmatum koreanum*	1062–60	England	1960
″ *platanoides* 'Maylimb'	313–66	Belgium	1966
″ ″ 'Walderseei'	1762–25	England	1925
″ *pseudo-platanus* 'Brilliantissimum'	455–27	England	1927
″ ″ ″ 'Nervosum'	206–66	Holland	1966
″ ″ ″ rubrolatum	381–60	Hungary	1960
″ ″ ″ 'Simon Louis Freres'	745–55	England	1955
″ ″ ″ 'Tricolor'	208–66	Holland	1966
″ *rufinerve* f. *albo-limbatum*	804–38	England	1938
″ *palmatum* 'Shishigashira'	160–40	England	1940
″ *rotundilobum*	556–27	England	1927
″ *saccharinum* 'Lutescens'	552–27	England	1927
″ *schwerinii*	1201–51	Holland	1951
″ *turkomanicum* *	814–68	Russia	1968
″ *wilsoni*	568–27	England	1927
Aesculus hippocastanum 'Incisa'	19781	England	1926
Ailanthus altissima 'Aucubaefolia'	197–66	Holland	1966
″ ″ 'Pendulifolia'	1976–25	England	1925
Akebia × *pentaphylla*	162–49	Arn. Arb.	1932
″ *quinata* 'Longiracemosa'	176–49	Japan	1949
Alnus borealis *	454–35	Russia	1935
″ *fruticosa* *	967–65	Russia	1965
″ *glutinosa* 'Imperialis'	526–23	England	1923
″ *incana* f. *acutiloba*	340–58	England	1958
″ ″ 'Romulis Coccinea'	40–67	England	1967
″ *jourlensis* *	2075–65	England	1965
″ *subcordata*	265–24	England	1924
″ *viridis* 'Undulata'	1209–51	Holland	1951
Alyssum alpestre *	2317–65	W. Germany	1965
″ *calycinum* *	1167–63	France	1963
″ *cuneifolium* *	2290–65	W. Germany	1965
″ *diffusum* *	2286–65	W. Germany	1965
″ *markgrafii* *	2289–65	W. Germany	1965
″ *moellendorfianum* *	2293–65	W. Germany	1965
″ *nondensatum* *	783–63	France	1963
″ *overense* *	2324–65	France	1965
″ *repens* var. *transsilvanicum*	2314–65	Austria	1965
″ *scardicum* *	2313–65	Switzerland	1965
″ *spinosum* *	2297–65	France	1965
″ *tristachyum* *	1163–63	Sweden	1963
″ *wulfenianum* *	792–63	Scotland	1963
× *Amelasorbus hoseri*	214–39	Poland	1939
× ″ *raciborskiana*	215–39	Poland	1939
Andromeda polifolia 'Grandiflora Compacta'	605–52	Holland	1952

Name	*Record No.*	*Country*	*Year*
Arabis albida *	407–63	Scotland	1963
Aristolochia fimbriata *	471–62	Estonia	1962
Aronia melanocarpa ‘Wislei’	1210–51	Holland	1951
Artemesia arborescens	813–60	Bulgaria	1960
Aubretia montana *	409–63	Belgium	1963
Aurinia petraea *	2292–65	W. Germany	1965
Berberis angulosa	545–23	England	1923
″ *aggregata* ‘Barbarosa’	499–38	Holland	1938
″ *arido-calida*	612–42	England	1942
″ *aristata* var. *coriaria*	968–24	Sweden	1924
″ *bergmanniae*	399–34	France	1934
″ *dealbata* *	672–28	Crimea	1928
″ *dubia* *	660–30	England	1930
″ *hauniensis* *	733–26	Denmark	1926
″ *koehneana* *	1069–24	England	1924
″ *mekongensis* *	404–30	Scotland	1930
″ *rigidicans* *	396–37	France	1937
″ *stenophylla* ‘Corallina’	266–39	England	1939
″ ″ ‘Corallina Compacta’	267–39	England	1939
″ ″ ‘Gracilis Nana’	271–39	England	1939
″ ″ ‘Picturata’	469–58	England	1958
″ ″ ‘Semperflorens’	272–39	England	1939
″ *suberecta*	615–42	England	1942
″ *tsarongensis*	706–65	W. Germany	1965
″ *thunbergii* ‘Argenteo-marginata’	559–36	England	1936
″ ″ ‘Atropurpurea Superba’	2076–65	England	1965
″ ″ ‘Kobald’	2–66	Holland	1966
″ ″ ‘Rose Glow’	1979–65	W. Germany	1965
″ *turcomanica* var. *densiflora*	660–34	Holland	1934
″ *vilmorinii*	367–34	Ireland	1934
″ *wilsonae* ‘Globosa’	200–40	England	1940
″ ‘Autumn Cheer’	165–40	England	1940
″ ‘Fireflame’	167–40	England	1940
Berchemia giraldiana	98–31	France	1931
Betula apoiensis *	266–68	Japan	1968
″ *aurata* ‘Aurea’	1253–65	Holland	1965
″ *hoseri* *	216–39	Poland	1939
″ *jacquemontii*	1110–24	England	1924
″ *kochnei*	422–36	Germany	1936
″ *korschinskyi* *	808–68	Russia	1968
″ *litwinowii* *	57–64	Armenia	1964
″ *obscura* *	425–29	Poland	1929
″ *pamirica* *	971–65	Russia	1965
″ *pendula* var. *oycoviensis*	19646	Poland	1924
″ *procurva* *	1056–65	Russia	1965
″ *pubescens* var. *carpatica*	333–38	France	1938
″ ″ var. *soongarica*	918–26	Russia	1926
″ ″ ‘Tortuosa’	1172–67	Czechoslovakia	1967
″ *purpusii*	791–64	Poland	1964
″ *saposhnikovii* *	121–65	Russia	1965
″ *schugnanica* *	1284–71	Russia	1971

Name	*Record No.*	*Country*	*Year*
Betula tatewakiana *	780–66	Japan	1966
″ *tianschanica* *	262–36	Russia	1936
Buckleya lanceolata *	548–64	Japan	1964
Buddleia alternifolia	349–23	England	1923
″ *davidii* 'Black Night'	550–65	England	1965
″ ″ 'Fromow's Purple'	169–39	England	1939
″ ″ 'Variegata'	1066–62	England	1962
Buxus sempervirens 'Agram'	539–59	England	1959
″ ″ 'Latifolia Macrophylla'	499–52	England	1952
″ ″ 'Ponteyi'	1207–60	England	1960
″ ″ 'Vardar Valley'	352–35	Rumania	1935
Calluna vulgaris 'Alba Aurea'	1359–66	England	1966
″ ″ 'Alba Carlton'	1487–65	England	1965
″ ″ 'Alportii Praecox'	1407–51	Holland	1951
″ ″ 'Beoley Gold'	1369–66	England	1966
″ ″ 'Blazeaway'	1501–65	England	1965
″ ″ 'Durfordii'	1468–65	England	1965
″ ″ 'E. F. Brown'	1288–67	England	1967
″ ″ 'Elsie Purnell'	1498–65	England	1965
″ ″ 'Foxhollow Wanderer'	1473–65	England	1965
″ ″ 'Fred J. Chapple'	1356–66	England	1966
″ ″ 'Gnome'	1475–65	England	1965
″ ″ 'Golden Carpet'	1305–67	England	1967
″ ″ 'Golden Feather'	1364–66	England	1966
″ ″ 'Gold Haze'	1491–65	England	1965
″ ″ 'Goldsworth Crimson'	1355–51	England	1951
″ ″ 'Hookstone'	1340–66	England	1966
″ ″ 'Humpty Dumpty'	1467–65	England	1965
″ ″ 'Hyemalis'	1502–65	England	1965
″ ″ 'Janice Chapman'	893–70	England	1970
″ ″ 'Jay Vanstone'	1478–65	England	1965
″ ″ 'Kynance'	1459–65	England	1965
″ ″ 'Lock-na-seil'	1367–66	England	1966
″ ″ 'Lyle's Surprise'	1295–67	England	1967
″ ″ 'Mousehole'	1299–67	England	1967
″ ″ 'Multicolor'	1465–65	England	1965
″ ″ 'Orange Queen'	1341–66	England	1966
″ ″ 'Peter Sparkes'	1479–65	England	1965
″ ″ 'Prostrate Orange'	1333–66	England	1966
″ ″ 'Pyrenaica'	18788	England	1924
″ ″ 'Ralph Purnell'	1463–65	England	1965
″ ″ 'Robert Chapman'	1486–65	England	1965
″ ″ 'Rosalind'	1470–65	England	1965
″ ″ 'Ruth Sparkes'	1347–66	England	1966
″ ″ 'Silver Spire'	1469–65	England	1965
″ ″ 'Silver Queen'	1497–65	England	1965
″ ″ 'Sunset'	1300–67	England	1967
″ ″ 'Torulosa'	1485–65	England	1965
″ ″ 'Underwoodii'	1346–66	England	1966
″ ″ 'Walter Ingwersen'	894–70	England	1970
″ ″ 'White Gown'	1483–65	England	1965



Akebia × pentaphylla. *Drawing by P. Bruns.*

Name	*Record No.*	*Country*	*Year*
Caragana arborescens 'Albescens'	468–65	W. Germany	1965
" " 'Cucullata'	2229–25	England	1925
" *brevifolia*	345–26	China	1926
" *densa*	125–27	China	1927
" *franchetiana*	278–23	China	1923
" *laetna* *	60–64	Armenia	1964
" *pekinensis*	61–23	China	1923
" *tangutica* *	565–57	W. Germany	1957
" *tibetica*	464–27	England	1927
" *turfanensis* *	594–67	Russia	1967
" *turkestanica* *	2078–65	England	1965
Carpinus caucasica *	516–58	Russia	1958
Caryopteris clandonensis	562–36	England	1936
Catalpa hybrida 'Purpurea'	21929	France	1931
" *ovata* f. *flavescens*	2140–25	England	1925
Cedrus brevifolia	114–63	Cyprus	1963
Celastrus hookeri	1222–51	Holland	1951
Cercis griffithii *	313–64	W. Germany	1964
Chaenomeles japonica 'Dwarf Poppy'	195–61	Holland	1961
" *speciosa* 'Alba Grandiflora'	51–61	France	1961
" " 'Brilliant'	196–61	Holland	1961
" " 'Nivea Extus Coccinea'	685–66	Belgium	1966
" " 'Rowallane'	156–52	England	1952
" " 'Sanguinea Plena'	150–60	Holland	1960
" *superba* 'Benichidari'	188–61	Italy	1961
" " 'Colette'	126–60	France	1960
" " 'Coquelicot'	123–59	Holland	1959
" " 'Della Robbia'	192–61	Holland	1961
" " 'Elly Mossel'	274–61	Holland	1961
" " 'Etna'	193–61	Holland	1961
" " 'Fascination'	275–61	Holland	1961
" " 'Fire Dance'	197–61	Holland	1961
" " 'Grandiflora Rosea'	189–61	Holland	1961
" *speciosa* 'Mallarot'	53–61	France	1961
" *superba* 'Nicoline'	194–61	Holland	1961
" " 'Pink Lady'	278–61	Holland	1961
" " 'Ulidia'	277–61	Holland	1961
" " 'Vesuvius'	190–61	Holland	1961
" " 'Wakaba'	187–61	Italy	1961
Chamaecyparis formosensis *	415–25	Formosa	1925
" *lawsoniana* 'Green Hedger'	430–65	England	1965
" " 'Green Pillar'	431–65	England	1965
" " 'Stewartii'	315–70	Hungary	1970
" *nootkatensis* 'Variegata'	1808–65	England	1965
" *obtusa* 'Caespitosa'	650–65	England	1965
" " 'Compacta'	2209–25	England	1925
" " 'Filicoid Dwarf'	1046–71	England	1971
" " 'Hage'	1756–65	England	1965
" " 'Juniperoides Compacta'	651–65	England	1965
" " 'Kosteri'	1766–65	England	1965
" " 'Nana Contorta'	1756–65	England	1965

Name	*Record No.*	*Country*	*Year*
Chamaecyparis obtusa 'Nana Intermedia'	1742–65	England	1965
″ ″ 'Pygmaea Densa'	1744–65	England	1965
″ ″ 'Repens'	1757–65	England	1965
″ ″ 'Rigid Dwarf'	1743–65	England	1965
″ *pisifera* 'Aurea Nana'	1769–65	England	1965
″ ″ 'Filifera Aureovariegata'	324–65	W. Germany	1965
″ ″ 'Golden Mop'	1770–65	England	1965
″ ″ 'Gold Spangle'	990–68	England	1968
″ ″ 'Squarrosa Aurea'	326–65	W. Germany	1965
″ ″ 'Squarrosa Minima Aurea'	62–22	Ireland	1922
″ ″ 'Squarrosa Nana'	830–24	Ireland	1924
″ *taiwanensis* *	853–58	Sweden	1958
″ *thyoides* 'Andelyensis Nana'	1746–65	England	1965
″ ″ 'Conica'	1777–65	England	1965
″ ″ f. *glauca*	2199–25	England	1925
″ ″ 'Golden Twig'	1778–65	England	1965
Chionanthus retusus 'Forrest's Variety'	333–49	England	1949
Cladrastis lutea (pink flowers)	182–38	U.S.A.	1938
Clematis hexapetala	464–64	England	1964
″ *montana* 'Tetrarosi'	285–64	Belgium	1964
″ *ochroleuca*	261–28	Scotland	1928
Cornus alba 'Gouchaultii'	641–36	France	1936
″ ″ var. *sibirica* 'Westonbirt'	727–38	England	1938
″ *darvasica* *	976–65	Russia	1965
″ *mas* 'Alba'	603–67	Rumania	1967
″ ″ f. *nana*	19885	England	1925
″ ″ 'Sphaerocarpa'	277–33	Russia	1933
″ *meyeri*	823–68	Russia	1968
″ *oblonga* *	784–59	Scotland	1959
Corylus avellana 'Aurea'	459–29	Holland	1929
Cotinus coggygria 'Flame'	570–65	England	1965
″ ″ 'Notcutt's Variety'	257–40	England	1940
Cotoneaster adpressa var. *praecox* 'Park Carpet'	404–65	Holland	1965
″ *ascendens* *	1708–66	Sweden	1966
″ *armena* *	1698–66	Sweden	1966
″ *bullata* 'Firebird'	1709–66	Sweden	1966
″ *congesta* 'Jurgi'	115–63	W. Germany	1963
″ *conspicua*	1019–36	England	1936
″ ″ 'Nana'	2054–65	Holland	1965
″ *cooperi*	376–37	Ireland	1937
″ 'Cornubia'	634–65	England	1965
″ *crispii*	1694–66	Sweden	1966
″ *dammeri* 'Skogsholmen'	703–65	W. Germany	1965
″ *denticulata* *	211–27	Scotland	1927
″ *frigida* 'Aldenhamensis'	546–28	England	1928
″ ″ 'Montana'	431–52	Ireland	1952
″ *francheti* 'Sterniana'	292–56	England	1956
″ *glaucophylla* f. serotina	650–57	England	1957
″ *gracia* *	2056–65	Holland	1965
″ *harrysmithii* *	530–71	China	1971
″ *heterophylla* *	427–47	Scotland	1947

Name	*Record No.*	*Country*	*Year*
Cotoneaster hissarica *	977–65	Russia	1965
″ *horizontalis* 'Coralle'	1981–65	W. Germany	1965
″ ″ var. *kansuensis*	1704–66	Sweden	1966
″ ″ 'Little Gem'	15–52	England	1952
″ 'Hybrida Pendula'	410–61	England	1961
″ *khasiensis* *	1358–70	Holland	1970
″ *kitaibelii* *	1951–65	Holland	1965
″ *mucronata* *	1703–66	Sweden	1966
″ *multiflora* var. *granatensis*	1993–25	England	1925
″ *nitidifolia*	328–38	England	1938
″ *oligantha* *	1691–66	Sweden	1966
″ *praewalskii* *	802–63	E. Germany	1963
″ 'Robustus'	1688–66	Sweden	1966
″ *rothschildiana* *	596–65	England	1965
″ (*salicifolia* × *dammeri*) 'Saldam'	328–65	W. Germany	1965
″ *saxatilis* *	103–57	W. Germany	1957
″ *silvestri* *	1707–66	Sweden	1966
″ *splendens* *	1695–66	Sweden	1966
″ *suavis* *	1693–66	Sweden	1966
″ *submultiflora*	803–63	E. Germany	1963
″ *taylorii* *	1701–66	Sweden	1966
″ *turbinata* *	95–66	Scotland	1966
″ *valkenburg* *	190–68	England	1968
″ *villosula* *	1357–70	Holland	1970
″ *watereri*	194–40	England	1940
″ *watereri* 'Pendula'	716–65	W. Germany	1965
″ *zeravschanica* *	1697–66	Sweden	1966
″ 'Braendkjaer'	2053–65	Holland	1965
Crataegus azarolus	1336–70	Holland	1970
″ *berberifolia* *	1331–70	Holland	1970
″ *cerola* *	1319–70	Holland	1970
″ *chlorosarca* var. *pubescens*	1349–70	Holland	1970
″ *chrysocarpa* var. *phonoecia*	1341–70	Holland	1970
″ *chungtienensis* *	193–23	China	1923
″ *coleae* *	1321–70	Holland	1970
″ *crus-galli* var. *splendens*	1861–25	England	1925
″ *cuneata*	1343–70	Holland	1970
″ *hissarica* *	65–64	Armenia	1964
″ *kansuensis*	436–26	China	1926
″ *kyrtostyla* *	1293–63	Estonia	1963
″ *lucorum* *	1339–70	Holland	1970
″ *macrosperma* var. *acutiloba*	1340–70	Holland	1970
″ *microphylla*	462–35	Russia	1935
″ *monogyna* 'Contorta Coccinea'	2083–65	England	1965
″ ″ 'Pendula Rosea'	684–65	England	1965
″ ″ 'Pink Cork Screw'	250–66	England	1966
″ ″ 'Tortuosa'	642–65	England	1965
″ ″ 'Xanthoclada'	479–67	Holland	1967
″ *pentagyna*	1348–70	Holland	1970
″ *pringlei* var. *lobulata*	1350–70	Holland	1970
″ *ruscinonensis* *	754–65	France	1965

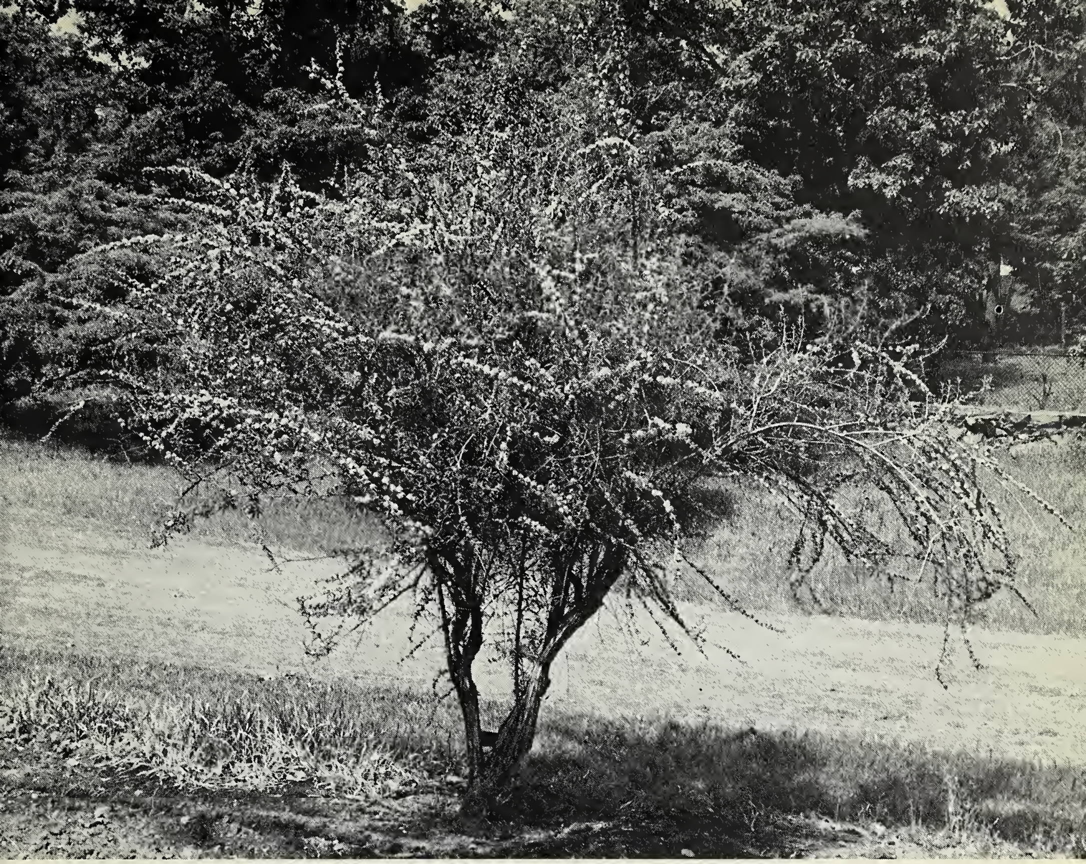
Top: Hamamelis *'Arnold Promise'. Photo by P. Bruns.*

Bottom: Cornus mas. *Photo by H. Howard.*

Name	*Record No.*	*Country*	*Year*
Crataegus semi-incisa *	1320–70	Holland	1970
″ *tortilis* *	1337–70	Holland	1970
″ *wattiana*	1342–70	Holland	1970
Cytisus cantabricus *	693–30	Ireland	1930
″ *frivaldskyanus* *	414–43	Scotland	1943
″ *reverchoni* *	415–43	Scotland	1943
″ *scoparius* 'Dragonfly'	14380	England	1924
″ ″ 'Golden Sunlight'	822–66	England	1966
Daboecia cantabrica 'Hookstone Purple'	1477–65	England	1965
″ ″ 'Porter's Variety'	1304–67	England	1967
Daphne glomerata	750–34	Asia Minor	1934
″ *cneorum* 'Pygmaea'	658–65	England	1965
″ ″ 'Variegata'	659–65	England	1965
″ *passerina* *	542–69	Russia	1969
Deutzia gracilis 'Albo-marginata'	24–65	Holland	1965
″ *discolor* 'Major'	614–65	England	1965
″ *hybrida* 'Azaleaflora'	1230–51	Holland	1951
″ *magnifica* 'Erecta'	1709–25	France	1925
″ 'Fleur de Pommier'	1232–51	Holland	1951
″ *magnifica* 'Superba'	1460–51	Holland	1951
″ *ningpoensis*	709–37	China	1937
″ *scabra* 'Albo-punctata'	2019–65	England	1965
″ ″ 'Eminens'	7–32	France	1932
″ ″ 'Longipetala'	1623–25	France	1925
″ ″ 'Macrocephala'	1996–25	England	1925
″ ″ 'Mirabilis'	1622–25	France	1925
″ *subulata* *	2015–65	England	1965
″ *staurothrix* *	2016–65	England	1965
″ *sunnyardii* *	2018–65	England	1965
″ *taiwanensis* *	409–66	Poland	1966
″ *vidalii* *	412–66	Poland	1966
″ 'Contraste'	12–32	France	1932
″ 'Magicien'	133–31	France	1931
″ 'Maguren'	2090–65	England	1965
″ 'Montrose'	1717–25	France	1925
″ 'Perle Rose'	1464–51	Holland	1951
Diervilla bifurca *	604–67	Rumania	1967
″ *splendens*	2128–25	England	1925
Edgeworthia papyrifera *	1235–63	Japan	1963
Elaeagnus oxycarpa *	1297–71	Russia	1971
Elsholtzia ciliata *	592–67	W. Germany	1967
Enkianthus campanulatus 'Pendulus'	100–66	Scotland	1966
″ *cernuus*	795–24	England	1924
Ephedra sinica	283–29	China	1929
Epigaea asiatica 'Apple Blossom'	191–68	England	1968
Erica australis 'Mr. Robert'	1301–67	England	1967
″ ″ 'Riverslea'	1350–66	England	1966
″ *carnea* 'December Red'	1287–67	England	1967
″ ″ 'Eileen Porter'	1476–65	England	1965
″ ″ 'Foxhollow Fairy'	1290–67	England	1967
″ ″ 'March Seedling'	1345–66	England	1966

Top: Buddleia alternifolia. *Photo by H. Howard.*

Bottom: Cornus stolonifera. *Photo by H. Howard.*



Name	*Record No.*	*Country*	*Year*
Erica ciliaris ‘Aurea’	1343–66	England	1966
″ ″ ‘Camla’	1338–66	England	1966
″ ″ ‘Maweana’	1452–65	England	1965
″ ″ ‘Norden’	1317–66	Holland	1966
″ *cinerea* ‘Atrosanguinea Smith’s Variety’	1461–65	England	1965
″ ″ ‘Cevennes’	1493–65	England	1965
″ ″ ‘Eden Valley’	1462–65	England	1965
″ ″ ‘Foxhollow Mahogany’	1464–65	England	1965
″ ″ ‘Fred Corston’	896–70	England	1970
″ ″ ‘Hookstone Lavender’	1472–65	England	1965
″ ″ ‘John Eason’	1481–65	England	1965
″ ″ ‘Joyce Burfitt’	1489–65	England	1965
″ ″ ‘Lilacina’	1474–65	England	1965
″ ″ ‘Lady Skelton’	1354–66	England	1966
″ ″ ‘Miss Waters’	1500–65	England	1965
″ ″ ‘Pink Ice’	1298–67	England	1967
″ ″ ‘Purple Beauty’	1357–66	England	1966
″ ″ ‘Romiley’	898–70	England	1970
″ ″ ‘Silberschmelze’	1493–65	England	1965
″ ″ ‘Smith’s Lawn’	1360–66	England	1966
″ ″ ‘Vivienne Patricia’	890–70	England	1966
″ ″ ‘W. T. Notley’	1344–66	England	1970
″ *mackaiana* ‘Lawsoniana’	1352–66	England	1966
″ *mediterranea* ‘Bohlje’	1319–66	Holland	1966
″ *tetralix* ‘Ken Underwood’	1490–65	England	1965
″ ″ ‘Pink Star’	1348–66	England	1966
″ *vagans* ‘Birch Glow’	1504–65	England	1965
″ ″ ‘Cream’	1488–65	England	1965
″ ″ ‘George Underwood’	1342–66	England	1966
″ ″ ‘Hookstone Rosea’	1361–66	England	1966
″ ″ ‘Miss Waterer’	1339–66	England	1966
″ ″ ‘Mrs. Donaldson’	1466–65	England	1965
″ *veitchii* *	1480–65	England	1965
″ ‘Furzey’	1482–65	England	1965
″ ‘Ghost Hills’	1292–67	England	1967
″ ‘James Smith’	1293–67	England	1967
Euonymus europaea ‘Acubaefolia’	1650–25	England	1925
″ ″ ‘Macrocarpa’	440–52	England	1952
″ ″ ‘Red Cascade’	16–52	England	1952
″ *fortunei* ‘Aurea Variegata’	1564–65	England	1965
″ ″ ‘Robusta’	1417–51	Holland	1951
″ *japonica* ‘Macrophylla’	139–31	France	1931
″ *myriantha*	619–65	England	1965
″ *sacrosancta* *	764–71	Russia	1971
″ *semenovii*	782–36	Russia	1936
Fagus sylvatica ‘Atropurpurea Macrophylla’	39–67	England	1967
″ ″ ‘Aureo-pendula’	664–65	England	1965
Fontanesia phillyreoides ‘Nana’	473–64	England	1964
Forsythia intermedia ‘Mertensiana’	83–57	Holland	1957
″ ″ ‘Tremonia’	23–66	W. Germany	1966
″ *mandshurica* *	857–67	Manchuria	1967

Name	*Record No.*	*Country*	*Year*
Forsythia ovata (special form)	507–52	England	1952
″ *suspensa* f. *atrocaulis* 'Nyman's Variety'	84–57	Holland	1957
″ 'Arnold Dwarf'	127–48	Arn. Arb.	1948
″ 'Arnold Giant'	262–47	Arn. Arb.	1947
″ 'Beatrix Farrand'	590–59	Arn. Arb.	1959
″ 'Karl Sax'	683–52	Arn. Arb.	1952
″ 'Tetra Gold'	406–65	Holland	1965
Fraxinus americana var. *juglandifolia*	461–25	Holland	1925
″ *insularis* *	1233–63	Japan	1963

to be continued

Lonicera ***'Arnold Red'***
Photo by H. Howard

HRG

Weeds: A Link With the Past

4. Shepherd's-purse

Shepherd's-purse (*Capsella bursa-pastoris*) is a small unobtrusive weed which grows along roadsides and in barren fields in most parts of the world. Its common name is very old, recalling a time when shepherds roamed the countryside. William Coles explained the name in 1657 in his book *Adam in Eden*: "In English it is called Shepherd's purse or Scrip, from the likeness the Seed hath with that kind of leatherne bag, wherein Shepherds carry their Victuals into the field."

It was also sometimes called "Clappe de pouch" because it resembled wallets carried by licensed beggars and lepers who stood by the road with bell, clapper, and pouch, making noise with the clapper to attract attention and ask for alms. Other names for the plant have been "Herdys purse," "Caffe weede," "Mothers Heart," and "Sanguinary." The last-mentioned name arose because of the plant's reputation for stopping blood, a characteristic known to the Romans and described by Pliny in the first century. The Greek Dioscorides, writing in his herbal *De Materia Medica*, mentioned it, calling it "Thlaspi."

In the 16th century in the Netherlands a physician by the name of D. Rembertus Dodoneus (sometimes also called D. Rembert Dodoens) described the uses of Shepherd's-purse in one of a series of books on the history of plants, modestly entitled, "The Second part of the Histoire of plantes/ in treating of the differences/ proportions/ names/ properties and vertues, of pleasant and sweete smelling floures, herbes and seedes, and such like. Writen by that famous D. Rembertus Dodoneus now Physition to the Emperour." His books were translated into English in the sixteenth century into the earthy language of that time:

> The Decoction of Shepherdes purse dronken, stoppeth the laske, the bloudy flixe, the spitting and pissing of bloud, women's termes, and all other fluxe of bloud, howsoever it be taken; for which it is so excellent, that some write of it, saying that

> it will stanche bloud if it be but only holden in the hande, or carried about the body."

John Josselyn, an early visitor to America, reported Shepherd's-purse in this country as early as 1672. The colonists used it as a potherb, and it has been reported that the young leaves were sold as greens in Philadelphia in the spring. Those who have tried it report that it tastes somewhat like cabbage but has a peppery flavor. Among other things it was recommended in colonial times for diarrhea, and Sir John Hill, writing in 1820 in *The Family Herbal*, stated, "the juice of the Shephard's purse is cooling and astringent."

A modern herbal written in 1959 recommends a tea made from the dried plant as a specific for stopping hemorrhages of all kinds, and reports that during World War I when the Germans could not obtain drugs used to stop bleeding they used instead a liquid extract of Shepherd's-purse.

Today the plant is not generally used, except in parts of China where it is eaten as a vegetable, but it continues to thrive as it did when Dodoneus wrote, "Sheepeherds pouche groweth in the streates and wayes and in rough, stonie, and untilled places."

HELEN ROCA-GARCIA

Arnoldia Reviews

The Rust Fungi of Cereals, Grasses and Bamboos, by George Baker Cummins

This descriptive and illustrated manual of the rust fungi occurring on grasses of the world is a concise and usable handbook for the mycologist or the person interested in these pathogens of grasses. The book was produced by photo-offset of a type script which produces a uniform but monotonous aspect due to the limitation of type characters. Individual dichotomous keys are given to the rust fungi occurring on about 240 genera of grasses. The format is not indented but fortunately no grass genus has more than 22 species of rust-fungi. A second group of keys treats the species of the 6 genera of rust fungi. *Puccinia*, with 291 species, is divided into groups. Each species of fungus is presented on a separate page and most are illustrated by line drawings of spores, mostly from type material. Literature references to original publications, synonymy, a descriptive paragraph, hosts and distribution, and an indication of the type specimen and its location are supplied. Two indices are offered of the fungus names and the names of grass hosts by genus and species. Monographers of other groups might well consider the excellence of this presentation as a model.

R. A. H.

George Baker Cummins, *The Rust Fungi of Cereals, Grasses and Bamboos*, New York: Springer-Verlag, 1971. 580 pages. $19.50.

The Great American Forest, by Rutherford Platt

Rutherford Platt has produced a dozen books and many articles popularizing nature by word and by superb well-chosen photographs. The Great American Forest was first published in 1965 and the current Prism Paperback edition makes this "classic" available at a moderate price. The coverage is historical, biological, geographical, and ecological, and there is a smattering of information on every conceivable aspect of the life cycle of a tree. The volume has been described as "fact-filled" and the writing as "artistic" but the combination is often too simplistic, becoming misleading to the general reader and annoyingly inaccurate to the professional.

R. A. H.

Rutherford Platt, *The Great American Forest*, Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1971. 271 pages. Prism Paperback. $2.95.

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Contents

49 Scientists and Scientific Contributions of the Arnold Arboretum. The First Century

Richard A. Howard

59 A Guide to City Trees in the Boston Area

Richard E. Weaver

98 *Arnoldia* in the kitchen

99 *Arnoldia* Reviews

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Scientists and Scientific Contributions of the Arnold Arboretum

The First Century

A bequest in the estate of James Arnold, probated in 1872, was accepted by the President and Fellows of Harvard University, and became the financial beginning of the Arnold Arboretum. The executors proposed the money be invested and accumulated until the endowment reached $150,000, after which 95% of the income could be used, with 5% being capitalized forever afterward. As Charles Sargent was appointed Director in 1873, he and his staff were financed primarily from other sources, such as the Harvard Botanic Garden and the Bussey Institution, for seven years until the Arnold Arboretum rightfully began to use its own money. While serving also as Director of the Botanic Garden in Cambridge, Sargent began to obtain seeds and plants to be used ultimately in the collections of the Arboretum. In his first report as Director of the Arnold Arboretum, Sargent wrote: "I am under deep obligation to Dr. Asa Gray for the valuable assistance and advice with which he has honored me from the very outset of the undertaking, and for an introduction to his numerous correspondents both in America and Europe."

In 1880 Sargent announced that the Arboretum had become financially and administratively independent of the Botanic Garden, and that "the separation of the Arboretum from the Botanic Garden, and its distance from the collections in Cambridge, have made the establishment of a separate Herbarium and Museum essential to its scientific position. The Museum is intended to illustrate the economic properties of trees both native and exotic; and the Herbarium will contain a reference set of ligneous plants to aid the determination of the living collections. A library of works on Dendrology and kindred subjects is also essential to the proper working of the Arboretum, and has been commenced." John Robinson of Salem, Massachusetts, as a volunteer, was the first curator, and his report indicated that on January 1, 1880, "the specimens previously collected by Professor Sargent, or otherwise received by donation, numbered 848 species and 1,073 specimens of unmounted plants." In the succeeding eight months, 1060 species and 2,736 specimens of dried plants were prepared at the herbarium or received by donations. During the year, 222 specimens were distributed to 19 different persons and institutions. The list of contributors of specimens included 28 American sources and two foreign — importantly, Mr. Brandis, the inspector of forests in India, and Sir J. D. Hooker of Kew.

Sargent's inspiration from Asa Gray, therefore, was to complement a living collection of hardy woody plants with a museum for public education, and an herbarium and a library to support the scientific work. This foundation remains but slightly altered over the century. The museum at its peak contained primarily specimens of large tree trunks, and eventually became a collection of small specimens of wood rather than a public display. The restricted interest in only woody plants remained until 1954, when the Arboretum began to add to its herbarium herbaceous plants, as well as Monocotyledons and ferns and their allies.

From the living collections, the herbarium and the library, however, the contributions of the Arnold Arboretum have been in the broad and perhaps ill-defined segregate areas of "botany" and "horticulture." Sargent and Olmsted, in planning the arrangement of plants on the grounds, recognized that the appeal of an arboretum could be enhanced with the proper arrangement of living plants. Although no avenue of single species was established, the placing of all lilacs in a highly visible group had a purpose. Today mass plantings of Forsythia and *Rhododendron obtusum* var. *kaempferi* are equally spectacular. Yet the folly of such groupings has also been shown by the loss of most cherry species from a conspicuous location by virus and nematode infections, as the separation of these trees from each other would minimize the spread of infection.

The contribution of the Arnold Arboretum in horticulture has been varied, and offered by many staff members over the years. The introduction of plants into cultivation by Sargent, Jack, Wilson and Rock, as employees doing exploration, was elaborated by others of the staff in acquiring seeds from other gardens through correspondence or by the financial support of other expeditions. The taxonomic work of Alfred Rehder in the preparation of the *Manual of Cultivated Woody Plants* and the most important *Bibliography of Cultivated Woody Plants* is outstanding. Sargent attempted to educate Americans through the short-lived publication, *Garden and Forest.* By contrast, *The Bulletin of Popular Information* went through three series of complex numbering before being renamed *Arnoldia*, now known for the articles by Wilson and Wyman. Independent of their salaried positions, Wilson wrote such lasting publications as: *China, Mother of Gardens*, *Aristocrats of the Garden*, and *America's Greatest Garden*; while Wyman's comparative observations of the living collections were expressed in his series such as *Trees for American Gardens*, or his most recent *Wyman's Garden Encyclopedia.*

When the International Society for Horticultural Science recognized the need for bibliographic data on cultivars of ornamental plants, the staff of the Arnold Arboretum took the lead in the preparation of lists of cultivar names, serving as an International and/or National Registration Center for cultivars of woody plants. Such listings have appeared in *Arnoldia.*

Plants introduced by an arboretum must be propagated and distributed to be of value, and again in accordance with its age, the Arnold Arboretum has played a major role. The records of plants handled as seed or cuttings by the propagators, Jackson Dawson, William Judd, Richard Filmore, Louis Lipp, Roger Coggeshall, and Alfred Fordham, are complete and will, some day, form the basis for a complete manual of vegetative plant propagation. The "Cooperating Nurseryman's Program," developed by Donald Wyman has placed many of the Arboretum's introductions in the commercial trade. The organization has been generous in offering surplus materials to other botanical gardens, to colleges and universities, and to Friends of the Arnold Arboretum.

Selections of chance seedlings on the grounds, a result of growing many species of plants, have yielded many interesting plants to American horticulture, including *Rosa arnoldiana*, *Malus arnoldiana*, *Lonicera* 'Arnold Red,' and *Hamamelis* 'Arnold Promise.' Cytological studies of cultivated plants by Karl Sax and his students led to deliberate crosses producing such cultivars as *Malus* 'Henrietta Crosby,' *Magnolia* 'Merrill' and several Forsythias. Sax's work on dwarfing plants, reviving old suggestions of the use of interstock and bark inversions, was widely adopted by the commercial trade. The early use of propagation frames of plastic, although neither original nor new in principle, used modern materials and was widely publicized.

Perhaps the earliest "popular classes" offered by American arboreta were the walks around the grounds of the Arnold Arboretum, conducted by J. G. Jack, which have continued and developed into numerous classes for the public.

As the first Director, Sargent's prime contributions to the scientific program of the Arnold Arboretum might well be considered *The Silva of North America*, and the *Manual of the Trees of North America*. These volumes are modified floras or monographs, featuring accurate descriptions by Sargent and the classic illustrations by Faxon. During Sargent's administration, E. H. Wilson was to collect in China and to write voluminously on the flora of temperate Asia. Alfred Rehder, as Curator, was responsible for the identification of most of the plant specimens Wilson collected which were associated with the introductions made for their horticultural significance.

The *Journal of the Arnold Arboretum* was started in 1919 as a place of publication of the scientific work of the staff. The four articles in the initial issue were on willows by Camillo Schneider; a phytogeographical sketch of the ligneous flora of Korea by E. H. Wilson; new taxa from the herbarium and living collections of the Arboretum by Alfred Rehder; and Notes on American Trees by C. S. Sargent. The Journal completed its 50th volume in 1970. It has been edited through the years by Rehder, A. C. Smith, C. E. Kobuski, C. E. Wood, Jr., and B. G. Schubert, all perfectionists, so that the periodical has a justified reputation for excellence.

A series of special publications, offered only for sale and not for exchange, had a short life due to excessive costs. The series began as *Contributions from the Arnold Arboretum* (11 numbers), and was renamed *Sargentia* (9 issues). While a need continues for a place for the publication of longer papers, the financial problems of printing and distribution remain.

When E. D. Merrill became Director in 1936, the research interest of the staff turned to Asia. Merrill invested a proportionately large amount of Arboretum funds in the support of local botanists in China, Indo-China, and tropical Asia, for the collection of plant specimens for scientific study. So large was the quantity of material, that some packages remain today unstudied for lack of staff to investigate the material. Merrill was a specialist on the flora of the Philippines, and recognized the paucity of materials and information on the islands further south. He encouraged collectors, including soldiers during World War II, to collect, and he was personally responsible for reporting quickly the initial determinations to genera. In this he was a master. With the beginning of the Archbold Expeditions to Papua and New Guinea, the Arboretum's association with that flora and the collections of Leonard Brass developed. Studies alone under the title of *Plantae Papuanae Archboldianae*, by Merrill and Lily M. Perry, number 21 papers in the *Journal of the Arnold Arboretum.*

Merrill's familiarity with the plants of the South Pacific allowed him to write a classic of its kind, *Edible and Poisonous Plants of the Islands of the Pacific*, which was published as a technical manual by the United States Army and served as a fundamental volume in the series of Survival Manuals to follow. The experience of working with Merrill and his volume allowed a graduate student, R. A. Howard, now Director of the Arboretum, to develop the Survival Training Program for the United States Forces. I. M. Johnston made a wartime contribution in taxonomic and ecological studies of San José Island, Panama. This program was one of the first to study the effects of chemicals as defoliants in tropical jungles. Contrasting were the studies made at the Arnold Arboretum in the use of plant materials for camouflage where studies of persistence of cut foliage were equally significant.

Although taxonomic studies using the herbarium and the library have dominated the contributions of the staff, there are areas of special contribution. Perhaps the contribution of I. W. Bailey in systematic and comparative wood anatomy is foremost. Bailey's early work was an individual effort exemplified by his studies of the cambium and its derivative tissues. Upon joining the Arboretum staff, Bailey began a cooperation with taxonomists in approaching problems of identification, relationship and evolution, perhaps culminating in the studies of the conduplicate carpel and the families of the woody "Ranales." The various articles which have appeared in the *Journal of the Arnold Arboretum* demonstrate the continuing interest of individual staff members and recognition by the institution of the value of an anatomical and morphological approach to systematic problems.

The Arnold Arboretum contributions in areas of cytology and genetics ranged from Sax's early work on the coiling of chromosomes to the numerical counts of chromosomes of cultivated plants produced by Edgar Anderson and continued by many others.

Only one staff member has carried the title of Ecologist, that being Hugh Raup, whose work involved the Mackenzie Basin, the Canadian Northwest Territories, and the Alcan Highway. Work in descriptive ecology, however, has been part of the published work of many staff members, from Johnston's work on gypsophiles and gypsophobes of Mexico, to the recent studies of alpine vegetation in the Caribbean by R. A. Howard and his associates.

Dr. J. Horace Faull was appointed pathologist on the Arboretum staff in 1928, and his small primitive laboratory was the first to recognize the occurrence of Dutch Elm disease in the United States. His many warnings of the potential of this disease went unheeded. With co-workers and students he amassed an herbarium of specimens of diseases of native as well as cultivated plants needed for the taxonomic studies of fungi. After his retirement, the field was not continued as a staff position, presumably due to the development of well-financed governmental laboratories by the State and Federal bureaus.

The library of the Arnold Arboretum began with private purchases by Charles Sargent of the books fundamental to his program. These were kept in his own residence until the Administration Building was built. Alfred Rehder was sent to Europe to buy books for the Arnold Arboretum library, and his choices resulted in most of the classic items with our collections. The interest of these two men in books is best expressed in the *Bradley Bibliography* of five volumes, one of the great privately sponsored works of the century. Merrill and Walker's *Bibliography of Eastern Asiatic Botany* must rank a close second.

Documentation of the library of the Arnold Arboretum was supplied by Miss Ethelyn Tucker in the three-volume annotated *Catalogue of the Library of the Arnold Arboretum.* Mrs. Lazella Schwarten made her contribution through the years of contribution to the *Torrey Index of American Literature.* The Schwarten and Rickett abbreviations of titles of periodicals can be regarded as the predecessors of more recent standardized lists of abbreviations.

To Merrill must go recognition for the initial efforts to reprint and make available rare volumes of taxonomic value. Using either Arboretum funds or his own, Merrill arranged for the reproduction of the works of Blume, Rafinesque, and others, before reprint and photocopied editions became commercial opportunities. Merrill also obtained the financial support required to place on microfilm photographic images of the specimens in the Linnaean Herbarium in the early years of World War II. This innovative procedure has also been adopted commercially today. Merrill brought to the Arnold Arboretum and implemented his idea of pasting the entries of the many volumes and supplements of Index Kewensis in one alphabetical sequence.

The work of the last decade of the first century is perhaps more familiar. It is exemplified by the selection, introduction, propagation or distribution of such plants as the Dawn Redwood (*Metasequoia*), *Malus* 'Donald Wyman,' and *Magnolia* 'Centennial' in the area of Horticulture. The floristic work of the current staff involves Hong Kong, the West Indies, and Mexico. Outstanding as an example of the value of utilizing the herbarium, the library, and good illustrative techniques, is the *Generic Flora of the Southeastern United States*, initially financed by a private benefactor, and more recently supported in part by a grant from the National Science Foundation. Other monographic work at the generic or familial level is published regularly in the *Journal of the Arnold Arboretum*. Horticultural taxonomy, as a prelude to work on a revision of Rehder's manual, has involved the building up of an herbarium of plants under cultivation in the United States while continuing the literature additions to the Rehder bibliographic files.

Over the first century, the endowment of the Arnold Arboretum has grown by gifts from individuals who value the efforts and the contributions of the staff. Gifts for current use, which Sargent required, remain today a need, and 2,000 persons are supporting the Arnold Arboretum on a regular basis as the "Friends of the Arnold Arboretum." The library in 1972 contains 80,000 books and pamphlets, and receives nearly 300 periodicals. The herbarium contains 936,000 specimens, of which 145,000 form an herbarium of cultivated plants. Modern greenhouses and laboratories for research are associated with the living collections and the teaching programs.

The distinguished heritage of the First Century is but the foundation of continued contributions of many present and future staff members.

RICHARD A. HOWARD

The following alphabetical list represents those members of the Arnold Arboretum staff with regular appointments who have contributed to our history through their publications. Only a brief indication of their title and contribution or area of investigation is possible. Many, of course, are dead, and reference is given to appropriate obituaries. Some are now at other institutions or have retired. All, however, contributed to the work for which the Arnold Arboretum is now known.

The Scientific Staff

Allen, Caroline K. 1926–28, 1932–48. Assistant in the Herbarium. Taxonomy — Lauraceae.

†Ames, Oakes. 1928–34. Professor, Supervisor. Taxonomy — Orchidaceae. (Jour. Arnold Arb. 31: 335–349. 1950)

†Anderson, Edgar. 1931–35. Arborist. Genetics: Tradescantia; horticultural articles.

†Asmous, Vladimir C. 1940–46. Assistant Librarian. Bibliography, biography Russian botanists.

†Bailey, Irving W. 1935–55. Professor. Comparative and systematic wood anatomy. (Jour. Arnold Arb. 49: 1–15. 1968)

Baranov, Andrey I. 1964–68. Curatorial Assistant. Flora of temperate Asia.

Bogle, Alfred L. 1967–70. Botanist. Generic Flora Southeastern States. Taxonomy — Hamamelidaceae.

†Brizicky, George K. 1960–68. Botanist. Generic Flora Southeastern States. Taxonomy and Nomenclature; history of subgeneric categories.

Channell, Robert B. 1955–57. Botanist. Generic Flora Southeastern States. Taxonomy — Ebenales, Primulales.

Chester, Kenneth S. 1931–32. Research Assistant in Phytopathology. Precipitin reactions.

Coggeshall, Roger C. 1954–58. Propagator. Vegetative reproduction.

Croizat, Leon. 1937–46. Technical Assistant. Taxonomy — Euphorbiaceae.

Crowell, Ivan H. 1931–33. Assistant Phytopathologist. Taxonomy — Gymnosporangium.

Darker, Grant D. 1928–33. Assistant in Phytopathology. Taxonomy of fungi.

Dermen, Haig. 1929–37. Assistant Cytologist; Assistant in Phytopathology. Chimeras.

DeWolf, Gordon P., Jr. 1967– . Horticultural Taxonomist; Horticulturist. Taxonomy — Moraceae.

Dudley, Theodore R. 1963–66. Assistant Horticultural Taxonomist. Taxonomy — Cruciferae.

Elias, Thomas S. 1969–71. Botanist. Generic Flora Southeastern States. Taxonomy — Leguminosae.

†Ernst, Wallace R. 1961–63. Botanist. Generic Flora Southeastern States. Taxonomy — Papaveraceae.

†Faull, Joseph H. 1928–40. Forest Pathologist. (Jour. Arnold Arb. 43: 223–233. 1962)

†Faxon, Charles E. 1882–1918. Curator, Artist. Silva North America. (Jour Arnold Arb. 3: 168. 1922; Rhodora 20: 117–122. 1918)

Fergueson, I. Keith. 1964–66. Botanist. Generic Flora Southeastern States. Taxonomy — Chenopodiaceae, Cornaceae.

† *Deceased.*

Fillmore, Richard H. 1947–51. Propagator. Vegetative propagation.

Flint, Harrison L. 1966–68. Associate Horticulturist. Plant hardiness.

Fordham, Alfred J. 1958– . Propagator. Vegetative propagation.

Graham, Shirley A. T. 1963–64. Botanist. Generic Flora Southeastern States. Taxonomy — Lythraceae, Rhizophoraceae, Polygonaceae.

Green, Peter S. 1961–66. Horticultural Taxonomist. Taxonomy — Oleaceae.

Hartley, Thomas G. 1964–71. Associate Curator. Flora of New Guinea.

Hou, Ding. 1955–56. Botanist. Flora of China project. Taxonomy — Celastraceae.

Howard, Richard A. 1954– . Director. Flora Lesser Antilles; plant anatomy.

Hu, Shiu-Ying. 1949– . Botanist. Flora of China; Flora of Hong Kong. Taxonomy — Ilex, Philadelphus.

†Jack, John G. 1886–1935. Associate Professor of Dendrology. Flora of Cuba; horticultural articles. (Jour. Arnold Arb. 30: 345–47. 1949)

James, Charles W. 1955–56. Botanist. Generic Flora Southeastern States. Taxonomy — Melastomataceae.

Jarrett, Frances M. 1956–59. Botanist. Taxonomy — Artocarpus.

†Johnston, Ivan M. 1931–60. Associate Professor. Taxonomy — Boraginaceae. (Jour. Arnold Arb. 42: 1–9. 1961)

†Jones, George N. 1937–38. Technical Assistant. Taxonomy — Sorbus, Tilia. (Plant Sci. Bull. 16: 10. 1970)

†Judd, William H. 1913–46. Propagator. Horticultural articles. (Jour. Arnold Arb. 27: 493. 1946; Arnoldia 6: 25–28. 1946)

†Kobuski, Clarence E. 1927–63. Curator, Editor of the Journal. Taxonomy — Theaceae. (Jour. Arnold Arb. 44: 411–420. 1963)

Li, Hui-Lin. 1941–43. Research Associate. Taxonomy — Araliaceae.

Lipp, Lewis F. 1952–54. Propagator. Vegetative propagation.

Liu, Su Y. 1954–56. Botanist, Flora of China project.

Lott, Henry J. 1937–38. Technical Assistant. Taxonomy — Hypericum.

Mangelsdorf, Paul C. 1940–41. Professor. Genetics of Zea mays.

†McKelvey, Susan D. 1931–64. Research Assistant. Taxonomy — Syringa, Yucca; history of botanical exploration. (Jour. Arnold Arb. 46: 45–71. 1965)

†Merrill, Elmer D. 1935–46. Director. Floras of tropical Asia; history of Cooks Voyages. (Jour. Arnold Arb. 37: 197–216. 1956)

†Metcalfe, Franklin P. 1941–42. Research Assistant. Flora of China.

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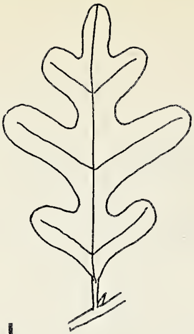
A Guide to City Trees In the Boston Area

From the number of specimens which are brought or sent to the Arnold Arboretum for identification, it is obvious that many people are interested in knowing the names of trees growing in their yards or along the streets of their communities. It is also clear that there is a need for a readily available and effective guide to the identification of city trees. Several guides are already available, but many of these cover too many species over too large an area, or else they are too technical, to be easily used by the average person. The guide which is presented here covers only the trees which grow wild or are cultivated in the Boston metropolitan area. Technical language is avoided wherever possible, and it is hoped that this guide will be useable by people without any botanical or horticultural training.

Before trying to identify a tree by means of this guide, one must first be able to tell a tree from a shrub. The distinction is not always easy to make. Size is not reliable because large shrubs are often taller than small trees. The important difference is that trees have only a single main trunk and the lowest branches are well above the ground level (except in conifers, where the lowest branches often extend to the ground level); shrubs have several to many main trunks and the lowest branches are usually almost at the ground level.

In this guide, the trees will be identified mostly by means of their leaves, simply because the leaves are conspicuous and they are available for at least seven months of the year. Flowers, fruits, twigs, and bark will also be used, but mainly as a supplement to the leaf characteristics. A discussion of the characteristics of leaves is presented below. It is important to read this section carefully, because the terms will be used throughout the guide. Most of the terms are illustrated by a drawing (figure) on page 60.

A leaf is basically made up of 2 parts, the flat, green portion, called the *BLADE*, and the stalk, called the *PETIOLE*. At the base of the petiole, where it is attached to the branch, is found a *BUD* (Figures 1–8) which will give rise to leaves, flowers, or branches next season. On the blade are a series of straight or branching lines, called *VEINS*. These veins carry food and



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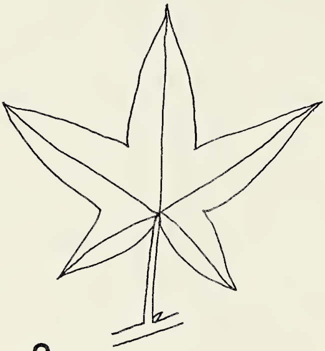

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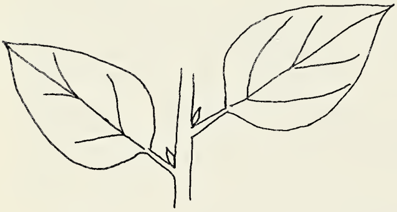

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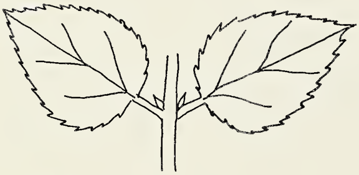

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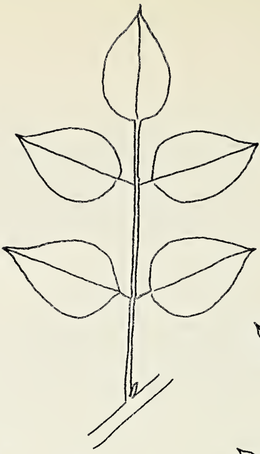

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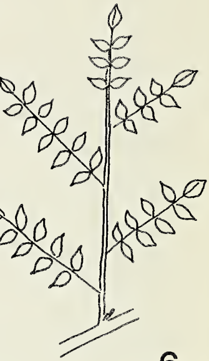

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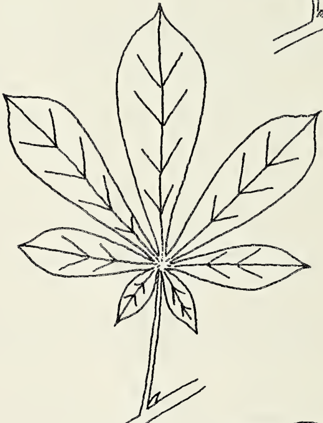

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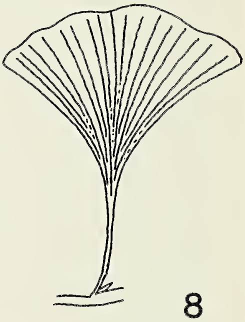

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Fig. 1. Pinnately Veined and Pinnately Lobed Leaf.
Fig. 2. Palmately Veined and Palmately Lobed.
Fig. 3. Alternate Leaves with Entire Margins.
Fig. 4. Opposite Leaves with Toothed Margins.
Fig. 5. Once-Pinnately Compound Leaf.
Fig. 6. Bipinnately Compound Leaf.
Fig. 7. Palmately Compound Leaf.
Fig. 8. Fan-shaped Leaf (Ginkgo).

water throughout the leaf. Most of the leaves in our area have a *MIDVEIN*, a large vein which runs down the middle of the leaf and is more prominent than the others (Figures 1, 3, 4). Branching off the midvein at regular intervals are smaller but still prominent *LATERAL VEINS* (Figures 1, 3, 4). Leaves with venation such as this, with a single midvein and lateral veins coming off at regular intervals are *PINNATELY VEINED*. Other leaves are *PALMATELY VEINED*. In this type there are 3 or more main veins which start from a point at the base of the blade (or the tip of the petiole) and spread like the fingers of an outstretched hand (Figure 2).

The edge of the leaf is known as the *MARGIN*. In many leaves the margin is smooth and even and then is termed *ENTIRE* (Figure 3). In other leaves the margin has small, rounded or sharp-pointed projections called *TEETH* (Figure 4), and sometimes there are small teeth on the larger ones, a condition termed *DOUBLE-TOOTHED*.

Some leaves have indentations which are much larger than teeth. The indentations between these projections usually reach at least halfway to the midvein. These projections are called *LOBES* and the indentations between them are called *SINUSES*. Leaves may be *PINNATELY LOBED*, as in oaks where the lobes are arranged like the teeth of a double-edged comb (Figure 1), or *PALMATELY LOBED*, as in maples where the lobes are arranged like the fingers of an outstretched hand (Figure 2). It is important to remember that pinnately lobed leaves are also pinnately veined, but not all pinnately veined leaves are lobed. The same is true for palmately lobed and palmately veined leaves. The margins of the lobes may be toothed or entire.

Pines, hemlocks, junipers and other conifers have leaves quite different from those already described. Leaves of these trees do not have a flat blade, but rather they are narrow and needle-like or scale-like. Many people do not think of pine needles as being leaves, but they are so nevertheless.

Most leaves are *SIMPLE*, that is, with a single blade and stalk (Figures 1–4). Others however are compound, with several blades, called *LEAFLETS*, attached to a single stalk. There are two basic types of compound leaves, just as there are of lobed leaves. *PINNATELY COMPOUND* leaves are those in which the leaflets are arranged at regular intervals along the stalk. *ONCE-PINNATELY COMPOUND* leaves have the leaflets attached directly on the main stalk (Figure 5). *BIPINNATELY COMPOUND* leaves have secondary stalks arranged at intervals along the main stalk (like leaflets on a once compound leaf) with the leaflets attached to these secondary stalks (Figure 6). *PALMATELY COMPOUND* leaves have all of the leaflets attached at one point and arranged like the spoke of a wheel or fingers on an outstretched hand (Figure 7). Only Horse Chestnuts of our trees have palmately compound leaves. Both palmately compound and pinnately compound leaves sometimes have only three leaflets.

Many people have trouble distinguishing a compound leaf from a branch with simple leaves. There should be no trouble, however, if one remembers that there is always a bud at the place where the leaf stalk is attached to the branch. Everything above that bud is part of a single leaf. There are no buds at the base of leaflets. Another thing which may be of help is the fact that leaves come off the twig in different planes, or in other words that they come off the twig in all directions. Leaflets, on the other hand, all come off the stalk in the same plane, and a compound leaf is always flat just as a simple one is.

When leaves are arranged singly on the twig (Figure 3), the arrangement is known as *ALTERNATE*; when they are in pairs (Figure 4), the arrangement is *OPPOSITE*. When the leaves are in 3's or more, the arrangement is *WHORLED*, a rare condition in trees of our area. In this guide, leaf arrangement is a very important characteristic for identifying trees. If the leaves are compound, it is essential that one looks at the leaves rather than the leaflets when deciding on the arrangement.

This guide makes use of an illustrated key for the identification of trees. A key is a series of statements describing certain characteristics of the thing to be identified, in this case trees. The characteristics described are those which most easily distinguish one tree from another. The statements are arranged in numbered pairs and one statement in each pair is in direct contrast to the other. To identify a plant by means of a key, read the first pair of statements carefully and decide which one of them best describes the plant to be identified. The statements of each pair are indented an equal distance from the margin; they may be separated some distance in the key, but they will have the same number and will always be indented equally. After a selection has been made, go to the pair of statements immediately below the one of the first pair selected, and repeat the process. Then go to the next pair and so on until the tree is named. It is important, when a selection is made from a pair of statements, to disregard everything above it in the key. Only that which is below it is relevant to the identification.

To use this key, turn to the "Summary Key" found below. Read the first pair of statements (the number 1's). If your tree has evergreen, needle-like leaves that are less than 1/4 inch broad, turn to Key A on page 64. If it instead has flat leaves that are more than 1/4 inch broad, go to the number 2's in the Summary Key and so on. If your tree, for example, has leaves which are not fan-shaped, but simple, opposite, and lobed, you would turn to Key F. Keys A to J work like the Summary Key. Each pair of statements may describe several characteristics. It is therefore important to read each statement in its entirety. If one cannot tell much from the first characteristic, the second or third may be of considerable help in making the choice. For example, look at the number 3's in Key B (Page 65). If you cannot decide whether your leaf has a gradually pointed tip or a bristle-tip, the distinctive fruits, if they are available, should enable you to make your choice easily.

There are many references to "Figures" (drawings) and "Plates" (photographs) throughout the key. These illustrate many of the characteristics used in the key, and in many cases will help you to decide whether or not your identification is correct.*

The help of Miss Ida Hay and Mrs. Sheila Geary in preparing the drawings is greatly appreciated.

RICHARD E. WEAVER

SUMMARY KEY

1. Leaves needle-like or scale-like, less than 1/4 inch broad, usually evergreen . . . . Key A (Page 64).
1. Leaves more than 1/4 inch broad, with a distinctly broad or flattened blade, usually deciduous.
    2. Leaves fan-shaped, without any large and conspicuous veins (Figure 8). . . . . *Ginkgo biloba*
    2. Leaves not fan-shaped, with at least one large and conspicuous vein.
        3. Leaves compound.
            4. Leaves with 3 leaflets. . . . Key B (Page 65).
            4. Leaves with more than 3 leaflets.
                5. Leaves palmately compound (Figure 7). . . . . Horse Chestnut (*Aesculus*)
                5. Leaves pinnately compound.
                    6. Leaves once-pinnate (Figure 5).
                        7. Leaves opposite. . Key C (Page 66)

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* These figures are not drawn to scale.

7. Leaves alternate. Key D (Page 67).
6. Leaves bipinnate (Figure 6). . . . . Key E (Page 68).

3. Leaves simple.
    8. Leaves opposite (Figure 4) or whorled.
        9. Leaves lobed (Figure 2) (If both lobed and unlobed leaves present, take this key.) . . . . Key F (Page 69).
        9. Leaves not lobed. . . . Key G (Page 70).
    8. Leaves alternate (Figure 3).
        10. Leaves lobed (Figures 1 & 2) (If both lobed and unlobed leaves present, take this key.). . . . . Key H (Page 72).
        10. Leaves not lobed.
            11. Leaves with toothed margins (Figure 4). . . . . Key I (Page 80).
            11. Leaves with entire margins (Figure 3). . . . . Key J (Page 90).

KEY A. LEAVES NEEDLE-LIKE OR SCALE-LIKE.

1. Leaves needle-like, more than 1/4 inch long, not completely covering the branchlets like shingles.
    2. Bark peeling off in long slender strips. . . . . Junipers (*Juniperus* sp.).
    2. Bark not peeling off in long slender strips.
        3. Needles in clusters of 2, 3, or 5 (Figure 9). . . . . Pines (*Pinus*).
            4. Needles in clusters of 5; open cones much longer than broad. . . . . White Pine (*Pinus strobus*).
            4. Needles in clusters of 2 or 3; open cones only slightly longer than broad, or about as broad as long.
                5. Needles usually in clusters of 3. . . . . Pitch Pine (*Pinus rigida*).
                5. Needles usually in clusters of 2.
                    6. Needles to 3 inches long, bluish, twisted . . . . Scots Pine (*Pinus sylvestris*).
                    6. Needles 3–8 inches long, green, not twisted . . . . Red Pine (*Pinus resinosa*).
        3. Needles borne singly along the branch (Figure 10) or in dense, rosette-like clusters on short spur-like branches (Figure 11).
            7. Needles borne in rosette-like clusters on short spur-like branches (Figure 11), or those on the new twigs borne singly.
                8. Needles flat, soft-textured . . . . Larches (*Larix* sp., Plate 1).
                8. Needles 3-sided, stiff. . . . . Cedar of Lebanon (*Cedrus libani*).
            7. Needles always borne singly along the branch (Figure 10).

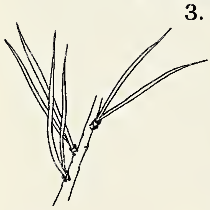


Fig. 9. Scots Pine.

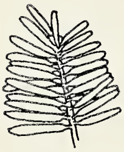


Fig. 10. Fir Needles.

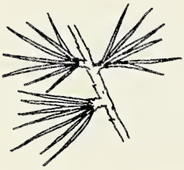


Fig. 11. Cedar of Lebanon.

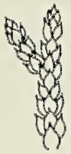


Fig. 12. Arborvitae.

9. Needles flat, with 2 fine, longitudinal whitish bands beneath.
    10. Needles 3/8–3/4 inch long; cones usually less than an inch long. . . . Hemlocks (*Tsuga* sp., Plate 2).
    10. Needles 3/4–1 and 1/2 inches long; cones more than an inch long.
        11. Needles about 1/16 inch broad often blue-green; cones hanging . . . . Douglas Fir (*Pseudotsuga taxifolia*).
        11. Needles more than 1/16 inch broad dark green; cones upright. Firs (*Abies* sp., Plate 3).
9. Needles 3- or 4-sided, without white lines beneath. . . . Spruces (*Picea* sp.).

1. Leaves scale-like, less than 1/4 inch long, completely covering the branchlets and overlapping like shingles (Figure 12); sometimes short needle-like leaves on the same plant.
    12. Branchlets square or round; trees often with both scale-like and needle-like leaves; fruit a round, bluish berry. . . . . Junipers (*Juniperus* sp., Plate 4).
    12. Branchlets flattened; trees with only scale-like leaves; fruit sometimes bluish, but not round or berrylike.
        13. Branchlets (or leaves) without whitish markings beneath. . . . . . Arborvitae (*Thuja* sp.).
        13. Branchlets (or leaves) with whitish markings beneath. . False Cypresses (*Chamaecyparis* sp.).

KEY B. LEAVES COMPOUND, WITH 3 LEAFLETS.

1. Leaves opposite.
    2. Leaflets with numerous (more than 15 per inch), fine, regularly spaced teeth; leaflets never lobed; fruit inflated, 3-pointed (Plate 5). . . . . Bladdernut (*Staphylea trifolia*, Figure 13).
    2. Leaflets with few (less than 5 per inch), coarse, irregularly spaced teeth; leaflets sometimes with 2 lobes near the base; fruit with 2 winged segments, not inflated (Figure 14). . . . . Box Elder (*Acer negundo*, Figure 15).

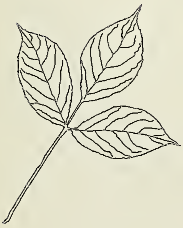


Fig. 13. Bladdernut.

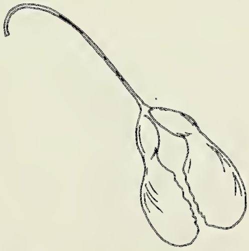


Fig. 14. Box Elder Fruit.

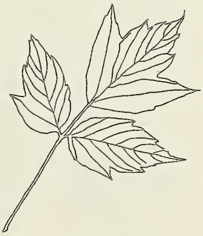


Fig. 15. Box Elder.

1. Leaves alternate.
   3. Leaflets tapering gradually to a pointed tip (Figure 16); margins of leaflets with indistinct, rounded teeth; fruit wafer-like, with 2 seeds (Figure 17); flowers greenish, inconspicuous. . . . . Wafer Ash (*Ptelea trifoliata*).
   3. Leaflets with a bristle at the tip (Figure 18); margins of leaflets without teeth; fruit bean-like, with more than 2 seeds; flowers yellow, conspicuous (Plate 6). . . . . Goldenchain Tree (*Laburnum* sp.).

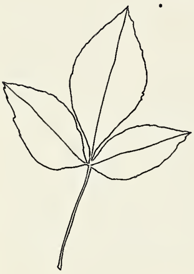


Fig. 16. Wafer Ash.

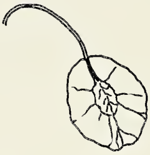


Fig. 17. Wafer Ash Fruit.

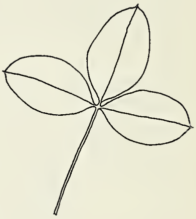


Fig. 18. Goldenchain Tree.

KEY C. LEAVES ONCE-PINNATELY COMPOUND, OPPOSITE.

1. Leaf scars completely encircling twigs (Figure 19); twigs green; leaflets 7 or fewer. . Box Elder (*Acer negundo*).
1. Leaf scars not encircling twigs (Figure 20); twigs brownish or grayish; leaflets often more than 7.
   2. Buds in axils of leaves almost completely covered by the base of the leaf stalk; leaves with a pleasant odor when crushed; fruit not winged. . . . . Cork Tree (*Phellodendron*).
   2. Buds in axils of leaves not covered by the base of the leaf stalk; leaves without a pleasant odor when crushed; fruit winged (Figure 21). . . . . Ashes (*Fraxinus*).

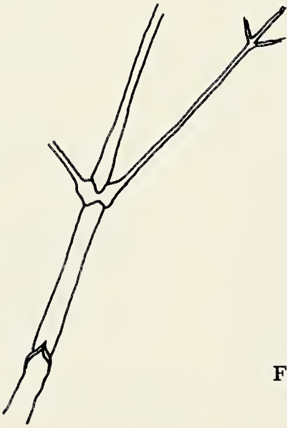


Fig. 19. Box Elder Leaf Scar.

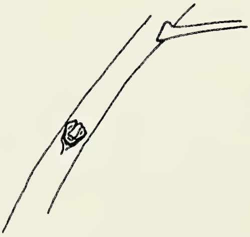


Fig. 20. Cork Tree Leaf Scar.

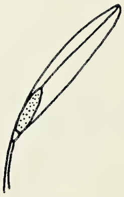


Fig. 21. Ash Fruit.

    3. Lateral leaflets without a stalk or with a very short one; buds black. . . . . European Ash (*Fraxinus excelsior*).
    3. Lateral leaflets with a distinct stalk; buds brown.
        4. Leaflets with hairs beneath, at least along the midvein. . . . . Green Ash (*Fraxinus pensylvanica*).
        4. Leaflets without hairs beneath. . . . . White Ash (*Fraxinus americana*).

KEY D. LEAVES ONCE-PINNATELY COMPOUND, ALTERNATE.

1. Trunk and larger branches with stout, branched spines. . . . . Honey Locust (*Gleditsia triacanthos*).
1. Trunk and branches without spines, or rarely with unbranched ones.
    2. Margins of leaflets without teeth, or with a few (1–4) near the base.
        3. Leaflets with a few teeth near the base (Figure 22); flowers and fruits not pea- or bean-like. . . . . . Tree of Heaven (*Ailanthus altissima*, Plate 7).

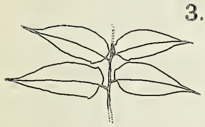


Fig. 22. Tree of Heaven.

        3. Leaflets entirely without teeth; flowers and fruits pea- or bean-like.
            4. Leaves with an even number of leaflets.
                5. Leaflets mostly opposite; pods tightly twisting upon opening (Figure 23); flowers yellow. . . . . Siberian Pea Tree (*Caragana arborescens*).

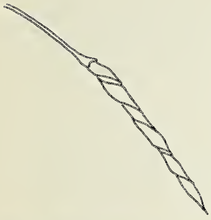


Fig. 23. Siberian Pea Tree Pod.

                5. Leaflets mostly alternate; pods not twisting upon opening (Figure 24); flowers pink or white. . Locust (*Robinia* sp.).
            4. Leaves with an odd number of leaflets.
                6. Terminal leaflet more than an inch broad.
                    7. Terminal leaflet distinctly broader than the upper lateral ones; bark smooth . . . . Yellow-wood (*Cladrastic lutea*).
                    7. Terminal leaflet about as broad as the upper lateral ones; bark ridged. . . . Amur Maackia (*Maackia amurensis*).

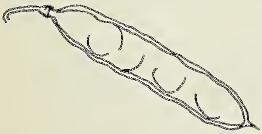


Fig. 24. Locust Pod.

                6. Terminal leaflet less than an inch broad.
                    8. Leaflets tapering to a sharp tip; twigs green; flowers appearing in the summer . . . . Pagoda Tree (*Sophora japonica*).
                    8. Leaflets with a blunt or rounded tip; twigs brown; flowers appearing in the spring. . . . . Locust (*Robina* sp., Plate 8).

2. Margins of leaflets with regular, evenly spaced teeth.
    9. Teeth rounded; middle lateral leaflets usually less than an inch long; fruit a long, brown slightly twisted pod. . . . . Honey Locust (*Gleditsia triacanthos*).
    9. Teeth sharp-pointed; middle lateral leaflets more than an inch long; fruit a nut or apple-like.
        10. Leaflets more than 9.
            11. Leaves less than 8 inches long, the leaflets always opposite; leaflets and leaf stalks without hairs and the latter usually red; fruits like small apples, less than 1/2 inch in diameter, in large clusters (Plate 9). . . . . Mountain Ash (*Sorbus* sp.).
            11. Leaves more than 8 inches long, the leaflets often alternate; leaflets and leaf stalks hairy, the latter greenish or brownish; fruit a nut, more than 1/2 inch in diameter, borne singly or in groups of 2–6. . . . . . . Walnuts (*Juglans*).
                12. Leaf scars with a prominent band of hairs on the upper edge; teeth of leaflets pointed outward; nuts longer than broad. . . . . Butternut (*Juglans cinerea*).
                12. Leaf scars without a band of hairs on the upper edge; teeth of leaflets pointing forward or inward; nuts usually as broad as long. . . . . . Black Walnut (*Juglans nigra*).
        10. Leaflets 9 or fewer. . . . Hickories (*Carya*).
            13. Bark peeling off in long strips (Plate 10). . . . Shagbark Hickory (*Carya ovata*).
            13. Bark ridged or smooth, not peeling off in long strips.
                14. Leaflets 7–9; leaf stalks hairy or fuzzy . . . . Mockernut (*Carya tomentosa*).
                14. Leaflets 5 or sometimes 7; leaf stalks not hairy. . . . . Pignut (*Carya glabra*).

KEY E. LEAVES BIPINNATE.

1. Twigs prickly. . . Devil's Walkingstick (*Aralia spinosa*).
1. Twigs not prickly, but sometimes branches with stout, branched spines.
    2. Trunk and larger branches with stout, branched spines. . . . . . . Honey Locust (*Gleditsia triacanthos*).
    2. Tree entirely without spines.
        3. Leaflets not toothed; fruits pea- or bean-like; flowers pink or greenish-white.
            4. Leaflets less than 1/4 inch broad; flowers

pink, in powder puff-like clusters; (Plate 11). Pods thin and papery, pale brown. . . . . Silk Tree (*Albizia julibrissin*).

4. Leaflets 1/2 inch or more broad; flowers greenish-white, in long, open clusters; pods thick, and dark brown. . . . . Kentucky Coffee Tree (*Gymnocladus dioicus*).

3. Leaflets toothed; fruit not pea- or bean-like; flowers yellow . . . . Golden Rain Tree (*Koelreuteria paniculata*, Plate 12).

KEY F. LEAVES SIMPLE, OPPOSITE OR WHORLED, LOBED.

1. Leaves pinnately veined and often in whorls of 3, usually more than 6 inches long; flowers large, white, appearing early in the summer, well after the leaves; fruit a long, cigar-shaped pod. . . . . . Catalpa (*Catalpa* sp.).

1. Leaves palmately veined and always opposite, usually less than six inches long; flowers small, greenish or red, appearing in the spring before the leaves or with them; fruit with 2 winged segments (Figure 25). . Maples (*Acer*).
    2. Leaf stalks producing a milky sap when broken. . . . . Norway Maple (*Acer platanoides*).

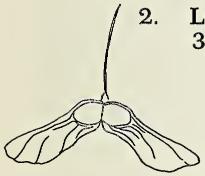


Fig. 25. Maple Fruit.

    2. Leaf stalks not producing a milky sap when broken.
        3. Leaves distinctly whitish beneath, not hairy.
            4. Leaves lobed about to the middle, the terminal lobe broadest at the base (Figure 26); leaves turning red in the autumn. . . . . Red Maple (*Acer rubrum*).
            4. Leaves lobed deeper than the middle, the terminal lobe broadest well above the base (Figure 27); leaves turning yellow in the autumn. . . . . Silver Maple (*Acer saccharinum*).
        3. Leaves green beneath, if slightly whitish then with hairs at least along the main veins beneath.
            5. Margins of lobes without teeth or with a few large irregularly spaced ones (Figure 28). . . . . . Sugar Maple (*Acer saccharum*).

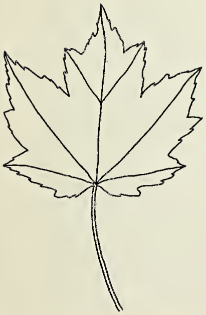


Fig. 26. Red Maple.

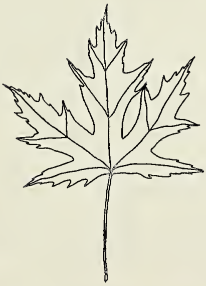


Fig. 27. Silver Maple.

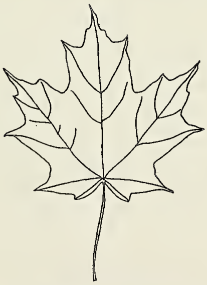


Fig. 28. Sugar Maple.

5. Margins of lobes with numerous small, regularly spaced teeth (Figure 29).
    6. Leaves with 7 or more lobes (Figure 29).
        7. Leaf stalks hairy to the base. . . . . Siebold Maple (*Acer sieboldianum*).
        7. Leaf stalk without hairs or hairy only in the upper portions.
            8. Leaves with 7 lobes. . . . . . : Japanese Maple (*Acer palmatum*).
            8. Leaves with 9 or more lobes. . . . . Fullmoon Maple (*Acer japonicum*).

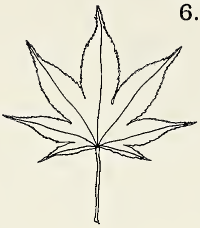


Fig. 29. Japanese Maple.

    6. Leaves with 3–5 lobes.
        9. Leaves red when mature. . . . . Japanese Maple (*Acer palmatum*).
        9. Leaves green when mature.
            10. Leaves thin-textured, 3-lobed, the terminal lobe larger than the others and always triangular (Figure 30) . . . . Striped Maple (*Acer pensylvanicum*).
            10. Leaves thicker-textured, 5-lobed, the terminal lobe only slightly larger than the two adjacent ones and usually with parallel sides. . Sycamore Maple (*Acer pseudoplatanus*).

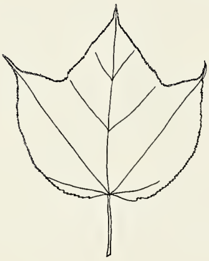


Fig. 30. Striped Maple.

KEY G. LEAVES SIMPLE, OPPOSITE OR WHORLED, NOT LOBED

1. Leaves palmately veined; margins of the leaves with rounded teeth (Figure 31) . . . . Katsura Tree (*Cercidiphyllum japonicum*).
1. Leaves pinnately veined; margins of the leaves without teeth or with sharp-pointed ones.
    2. Leaves toothed.
        3. Leaf stalks about half as long as the blades; leaves often heart-shaped at the base and often with 2 small lobes near the base. . . . . Tatarian Maple (*Acer tataricum*).
        3. Leaf stalks considerably less than half as long as the blades; leaves never heart-shaped at the base and never with lobes.
            4. Leaves with very numerous (more than 20 per inch) fine teeth; leaves and leaf stalks without hairs; flowers and fruits on long slender drooping stalks; fruits with 4–5 very prominent ridges . . . . Broadleaf Burningbush (*Euonymus latifolia*).

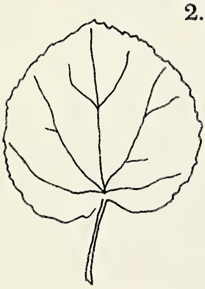


Fig. 31. Katsura Tree.

4. Leaves with fewer (usually less than 10 per inch) and usually coarse teeth, or sometimes with only indistinct teeth; leaves, at least along the main veins beneath, or leaf stalks hairy; flowers and fruits in upright clusters; fruits without ridges.
    5. Leaves mostly less than 1 inch broad; bark peeling off in long strips. . . . . . . Beautybush (*Kolkwitzia amabilis*, Plate 13).
    5. Leaves more than 1 inch broad; bark not peeling off in long strips.
        6. Flowers of 2 kinds in the same cluster (small inconspicuous ones and others with 4 large, papery "petals"); old flowers persisting into the winter; fruit not berry-like. . . . . . . Panicle Hydrangea (*Hydrangea paniculata*, Plate 14).
        6. Flowers uniform in each cluster, all small; old flowers falling off after blooming; fruit a dark, oval or roundish berry . . . . Siebold Viburnum (*Viburnum sieboldii*).

2. Leaves not toothed.
    7. Bark peeling off in long strips. . . . . Beautybush (*Kolkwitzia amabilis*).
    7. Bark not peeling off in long strips.
        8. Largest leaves more than 4 inches broad and the leaf stalks of these more than 2 inches long; leaves often with 2 lobes near the base.
            9. Flowers purple, appearing before the leaves; fruit not cigar-shaped; leaves never whorled. . . . . Princess Tree (*Paulownia tomentosa*).
            9. Flowers white, appearing after the leaves are well developed (Plate 15); fruit long and cigar-shaped (Plate 16); leaves often in whorls of 3. . Catalpa (*Catalpa* sp.).
        8. Largest leaves usually less than 4 inches broad and the stalks of these always less than 2 inches long; leaves never with lobes.
            10. Uppermost pair of lateral veins running directly into the tips of the leaf; flower clusters with 4 large, white, petal-like bracts at base. . Dogwoods (*Cornus*).
                11. Flower bracts indented at the tip (Plate 17); fruits shiny, red, berry-like, in clusters (Plate 18); buds (those enclosing next year's flowers) flat-topped . . . . Flowering Dogwood (*Cornus florida*).

- 11. Flower bracts pointed at the tip (Plate 19); fruit a solitary, dull red, warty, ball-like structure (Plate 20); buds (those enclosing next year's flowers) pointed. . . . . Kousa Dogwood (*Cornus kousa*).
- 10. Uppermost pair of lateral veins not running into the tip of the leaf; flowers in open clusters without conspicuous bracts.
  - 12. Leaves hairy, at least on the veins beneath, oval-shaped; individual flowers with long, slender petals. . . . . Fringe Trees (*Chionanthus*, Plate 21).
    - 13. Leaf blades usually less than 3 inches long, often with blunt tips. . . Chinese Fringetree (*Chionanthus retusus*).
    - 13. Leaf blades usually more than 3 inches long, with sharply pointed tips. . . . . White Fringetree (*Chionanthus virginicus*).
  - 12. Leaves not hairy beneath, egg-shaped; individual flowers with short, roundish petals. . . . . Tree Lilac (*Syringa mandshurica*).

KEY H. LEAVES SIMPLE, ALTERNATE, LOBED

- 1. Leaf stalk producing a milky sap when broken; fruit juicy, somewhat resembling a raspberry or blackberry. . . . . Mulberry (*Morus* sp.).
- 1. Leaf stalk not producing a milky sap when broken; fruit not juicy, not resembling a blackberry.
  - 2. Young twigs and the undersides of the leaves densely covered with a smooth, white, felt-like fuzz. . . . . White Poplar (*Populus alba*).
  - 2. Young twigs and the undersides of the leaves not covered with a white felt-like fuzz, although the leaves sometimes are somewhat whitish beneath.
    - 3. Leaves palmately veined.
      - 4. Margins of the lobes with numerous, small regularly spaced teeth; leaves with a pleasant odor when crushed; twigs usually with corky ridges . . . . Sweet Gum (*Liquidambar styraciflua*, Figure 32).
      - 4. Margins of the lobes with few, coarse irregularly spaced teeth; leaves without a pleasant odor when crushed; twigs without corky ridges . . . . . Sycamore (*Platanus* sp., Figure 33).

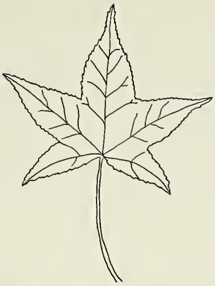


Fig. 32. Sweet Gum.

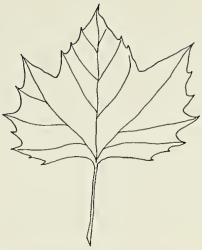


Fig. 33. Sycamore.

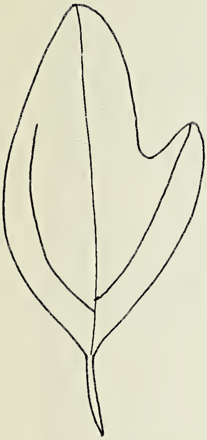


Fig. 34. Sassafras.

3. Leaves pinnately veined.
   5. Branches with long, slender spines. . . . . Hawthorn (*Crataegus* sp.).
   5. Branches without spines.
      6. Bark of trunk white; leaves small, the blade usually less than 2 inches long. . . . . European Cutleaf Birch (*Betula pendula*).
      6. Bark not white; leaves larger, the blade more than 2 inches long.
         7. Bark of trunk smooth, without ridges or cracks . . . . Fernleaf Beech (*Fagus sylvatica* var. *laciniata*).
         7. Bark of mature trunk with ridges and cracks.
            8. Twigs with a strong, pleasant odor when bruised; fruit not an acorn.
               9. Twigs bright green; leaves usually of 3 kinds on a single tree [some without lobes, some with one lobe near the base and then mitten-shaped (Figure 34), and some with a lobe on each side below the middle (Figure 35)] but the tip of the leaf pointed or rounded. . . . . Sassafras (*Sassafras albidum*).
               9. Twigs dark green; leaves all the same kind on each tree, the tip squarish or indented (Figure 36). . . . . Tulip Poplar (*Liriodendron tulipifera*).

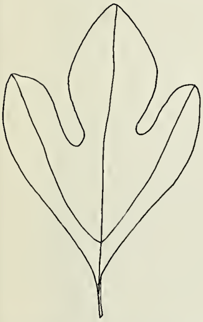


Fig. 35. Sassafras.

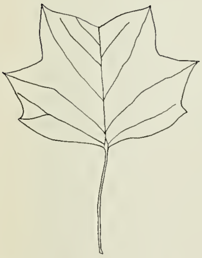


Fig. 36. Tulip Poplar.

8. Twigs without a pleasant odor when bruised; fruit an acorn. . . . . . Oaks (*Quercus* sp.).
    10. Tips of the lobes rounded or blunt (Figure 37).
        11. Acorns without a stalk or on a very short, stout one; the sinuses of at least some of the lobes reaching nearly (at least 2/3 of the way) to the midvein; base of the blade tapering gradually to the stalk . . . . White Oak (*Quercus alba*, Figure 37).
        11. Acorns on a long, slender stalk; sinuses of the lobes not extending more than halfway to the midvein; base of the blade narrowed abruptly to the stalk. . . . . English Oak (*Quercus robur*).

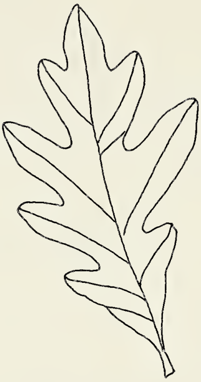


Fig. 37. White Oak.

    10. Tips of the lobes extended into a narrow bristle (Figure 38).
        12. Undersides of the leaves with a fine fuzz that rubs off as a fine, brownish powder . . . . Black Oak (*Quercus velutina*).
        12. Undersides of the leaves without a fine fuzz, but sometimes with tufts of hairs in the places where the lateral veins join the midvein.
            13. Undersides of the leaves with conspicuous tufts of pale hairs in the places where the lateral veins join the midvein; sinuses of some of the lobes extending nearly to the midvein (Figure

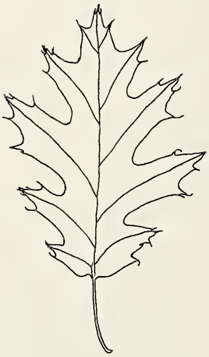


Fig. 38. Red Oak.

39); tree with a pyramidal shape, the lower branches pointing somewhat downward (Plate 22). . . . . . Pin Oak (*Quercus palustris*).

13. Undersides of the leaves without conspicuous tufts of hairs, or rarely with small tufts of dark ones; sinuses of the lobes usually not extending more than half-way to the midvein (Figure 38); tree with a more rounded shape, the lower branches pointing outward or upward. . Red Oak (*Quercus rubra*).

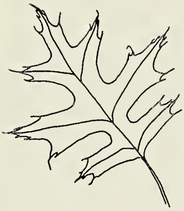


Fig. 39. Pin Oak.

Note: Scarlet Oaks (*Quercus coccinea*) may be found occasionally. They resemble Pin Oaks, but the lower branches do not point downward.

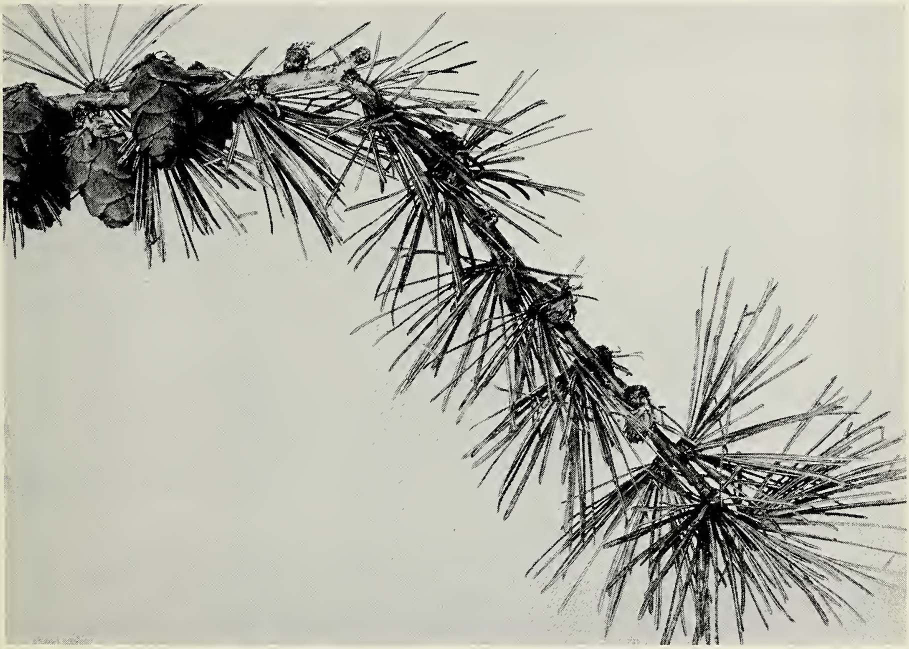


Plate 1. Larch (*Larix*)

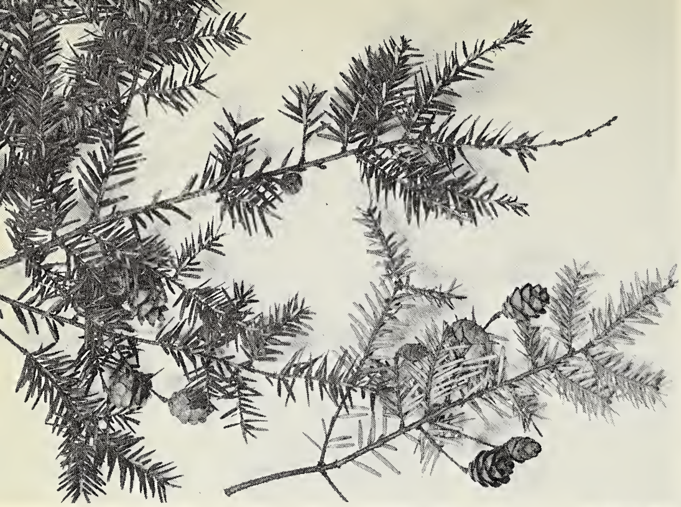


Plate 2. Hemlock
(*Tsuga*)

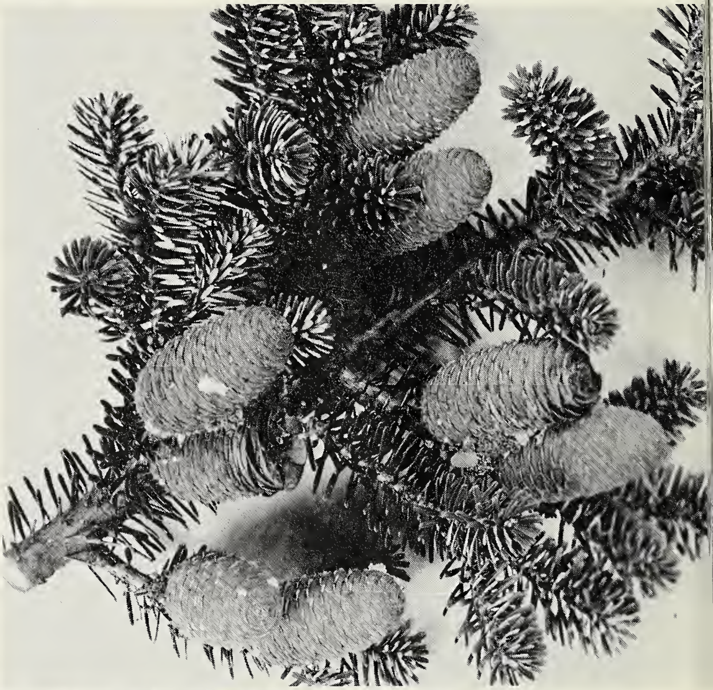


Plate 3.
Fir
(*Abies*)

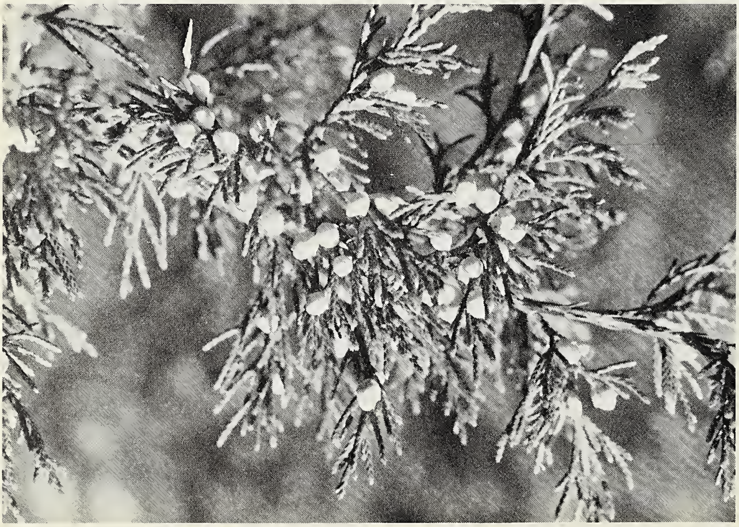
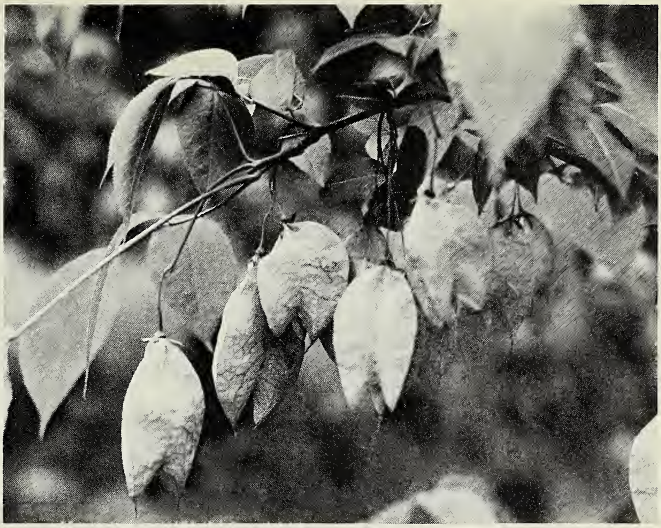


Plate 4.
Juniper
(*Juniperus*)

Plate 5.
Bladdernut
(*Staphylea*)



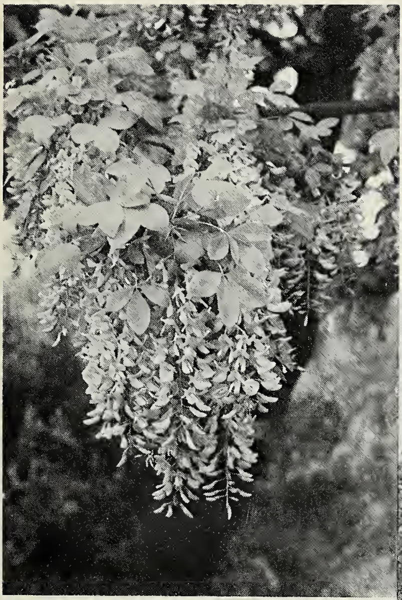


Plate 6
Goldenchain Tree
(*Laburnum*)

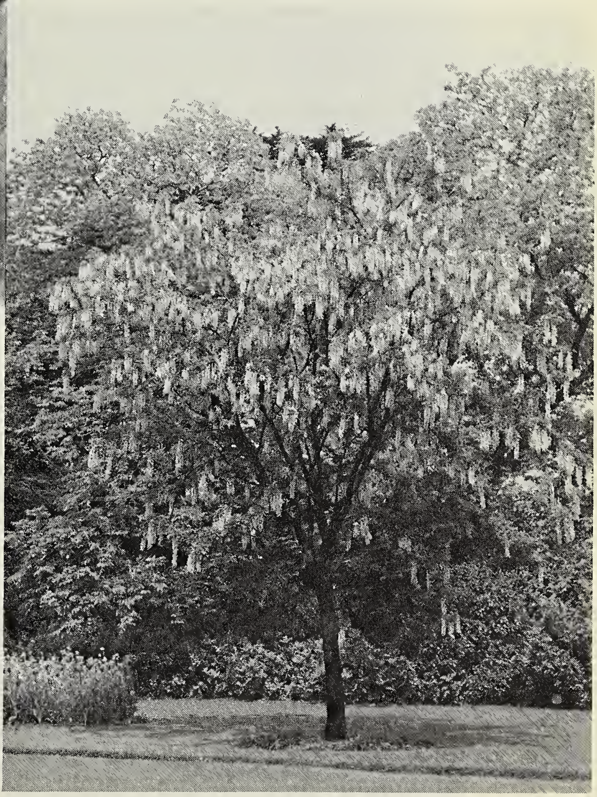


Plate 6A
Goldenchain Tree
(*Laburnum*)

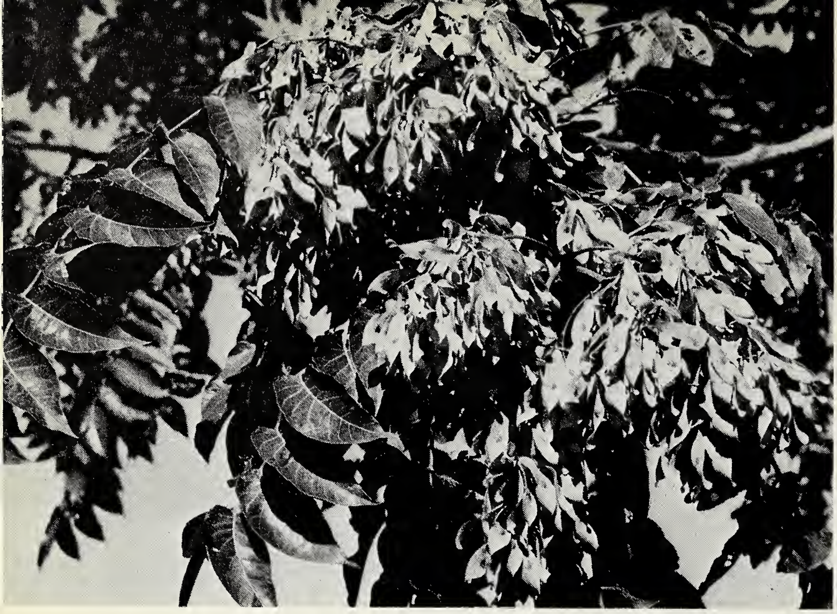
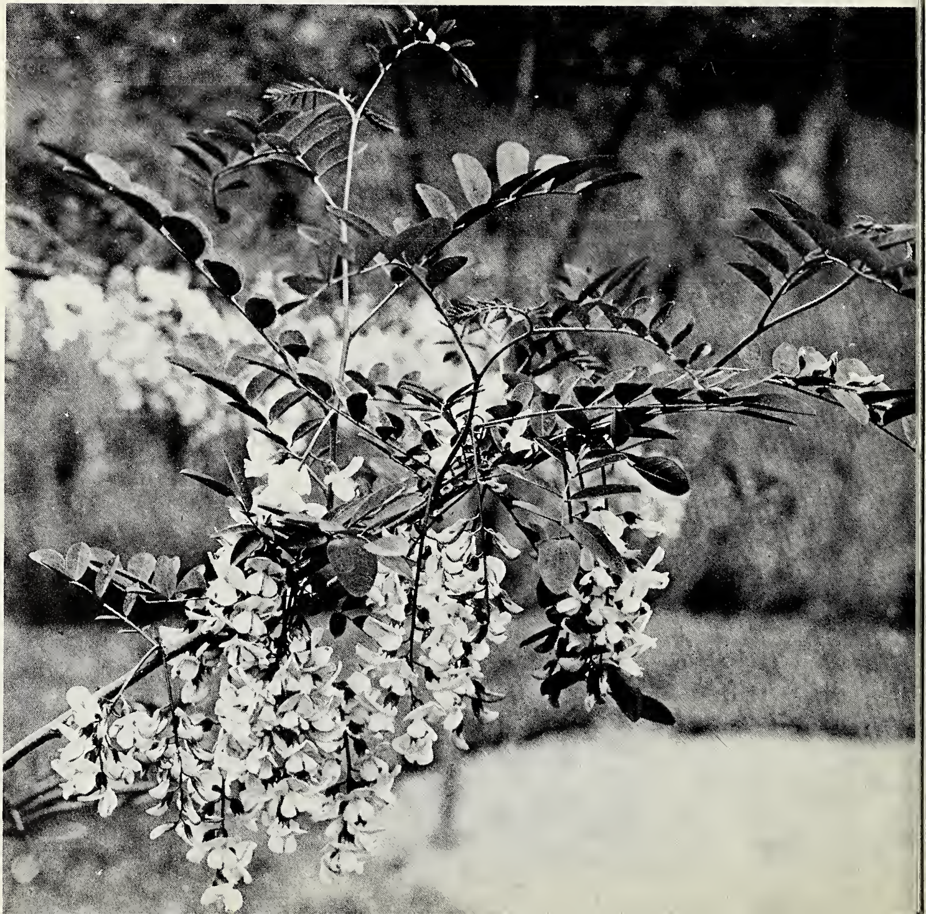


Plate 7. Tree of Heaven (*Ailanthus altissima*)

Plate 8. Locust (*Robinia*)



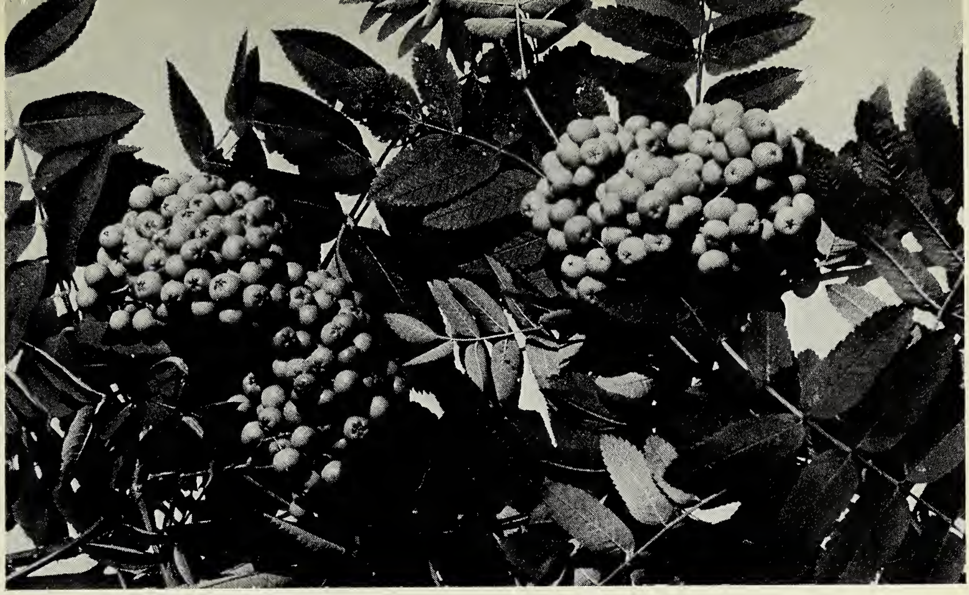
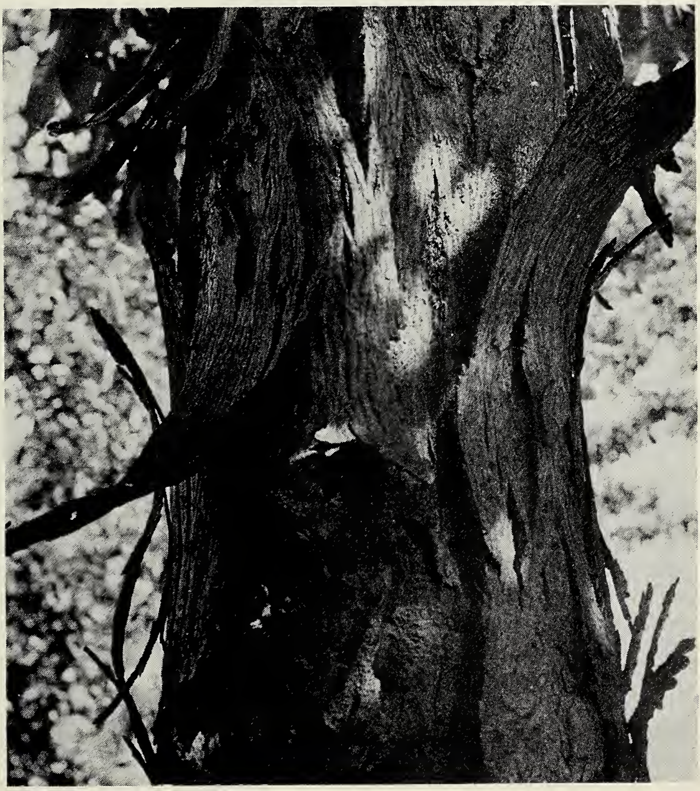


Plate 9. Mt. Ash (*Sorbus*)

Plate 10. Shagbark Hickory (*Carya ovata*)



KEY I. LEAVES SIMPLE, ALTERNATE, UNLOBED, WITH TOOTHED MARGINS.

1. Young twigs and the undersides of the leaves covered with a dense, white, felt-like fuzz that is easily rubbed off. . . . . White Poplar (*Populus alba*).
1. Young twigs and the undersides of the leaves not covered with a white fuzz, or rarely one or the other with a white fuzz, but never both.
  2. Leaves palmately veined.
    3. Teeth rounded. . . . Katsura Tree (*Cercidiphyllum japonicum*).
    3. Teeth sharp-pointed. . . . . . Lindens (*Tilia* sp., Figure 40).
  2. Leaves pinnately veined.
    4. Leaves heart-shaped. . . . . . Lindens (*Tilia* sp., Figure 40).
    4. Leaves not heart-shaped.
      5. Leaf stalks more than half as long as blade, often as long as the blade or longer.
        6. Bark of mature trunk white; leaves double-toothed (teeth on the teeth) (Figure 45). . . . . European Weeping Birch (*Betula pendula*).
        6. Bark not white; leaves single-toothed.
          7. Leaves lop-sided at the base (Figure 40); teeth with long, slender tips (bristle-tipped) (Figure 41). . . . . Lindens (*Tilia* sp.).
          7. Leaves not lop-sided at the base; teeth usually rounded, rarely sharp-pointed but never bristle-tipped.
            8. Leaf stalks flattened; leaves nearly as broad as long or sometimes broader than long, somewhat triangular or broadly diamond-shaped (rarely broadly egg-shaped), usually flat or broadly triangular at the base; flowers small, in fuzzy catkins, appearing before the leaves; fruit dry, fuzzy; branches never spiny.
              9. Leaves roundish or broadly egg-shaped (Figure 42).
                10. Leaves usually less than 2 inches broad; teeth fine, numerous (more than 10 per inch). . . . . Quaking Aspen (*Populus tremuloides*).
                10. Leaves usually more than 2 inches broad; teeth coarse, less than 10 per inch (Figure 42). . . . . Big-tooth Aspen (*Populus grandidentata*).

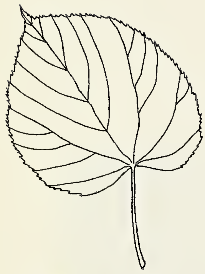


Fig. 40. Linden.

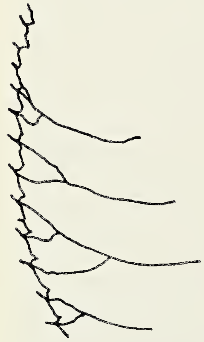


Fig. 41. Bristle-tipped Teeth.

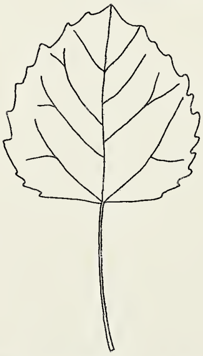


Fig. 42. Big-tooth Aspen.

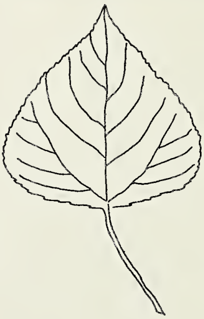


Fig. 43. Lombardy Poplar.

9. Leaves somewhat triangular shaped (Figure 43).

11. Trees with rounded crowns. . . . . Eastern Cottonwood (*Populus deltoides*).

11. Trees with tall, slender, spire-like crowns (Plate 23). . . . . Lombardy Poplar (*Populus nigra*).

8. Leaf stalks not flattened; leaves longer than broad, oval or egg-shaped, usually rounded at the base; flowers large, white, appearing with the leaves; fruit a pear; branches sometimes spiny. . . . . Pears (*Pyrus* sp.).

5. Leaf stalks less than half as long as the blade.

12. Branches with long, slender spines. . . . . Hawthorn (*Crataegus* sp.).

12. Branches without spines.

13. Main lateral veins reaching to the margin of the leaf, usually ending in teeth (Figure 44).

14. Leaves double-toothed (teeth on the teeth) (Figure 45).

15. Teeth rounded. . Witch Hazel (*Hamamelis* sp.).

15. Teeth sharp-pointed.

16. Leaves strongly lop-sided at the base (Figure 46); teeth curving inward (Figure 47). . . . . Elms (*Ulmus* sp.).

16. Leaves not lop-sided or only slightly so at the base; teeth pointing forward or outward (Figure 45).

17. Bark of mature trunks white (Plate 24).

18. Bark peeling off in papery strips; twigs and branches not drooping. . . . . . Paperbark Birch (*Betula papyrifera*).

18. Bark not peeling off in papery strips; branches and twigs drooping (Plate 25). . . European Weeping Birch (*Betula pendula*).

17. Bark not white.

19. Bark of twigs with a wintergreen taste. . . . . Sweet Birch (*Betula lenta*).

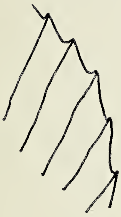


Fig. 44. Single-toothed Leaf Margin, with Veins Ending in Teeth.

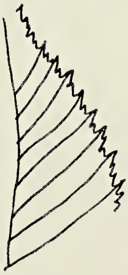


Fig. 45. Double-toothed Leaf Margin.

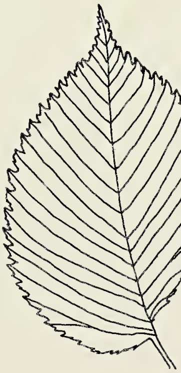


Fig. 46. Elm.

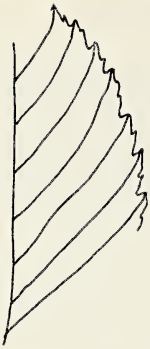


Fig. 47. Teeth of Elm Leaf.

19. Bark of twigs without a wintergreen taste.
    20. Tip of leaves blunt or tapering gradually to a short point (Figure 48); teeth projecting less than 1/16 inch from the margin; small trees or large shrubs. . . . Alders (*Alnus* sp.).
    20. Tip of leaves long and slender (Figure 49); teeth projecting more than 1/16 inch from the margin; medium-size to large trees.
        21. Bark of mature trees with conspicuous horizontal lines (Plate 26) . . . . Yellow Birch (*Betula lutea*).
        21. Bark of mature trees without conspicuous horizontal lines.
            22. Bark of mature trunks smooth (Plate 27) . . . . Hornbeams (*Carpinus* sp.).
            22. Bark of mature trees shaggy or flaking (Plate 28) . . . . . Hop Hornbeams (*Ostrya* sp.).

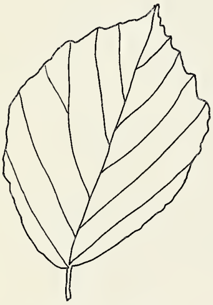


Fig. 48. Alder.

14. Leaves single-toothed (Figure 44).
    23. Leaves heart-shaped. . . . Lindens (*Tilia* sp.).
    23. Leaves not heart-shaped.
        24. Leaves strongly lop-sided at the base (Figure 50); teeth rounded; flowers appearing in the late fall or winter. . . . . Witch Hazels (*Hamamelis* sp.).
        24. Leaves not lop-sided at the base; teeth usually sharp-pointed; flowers appearing in the spring.

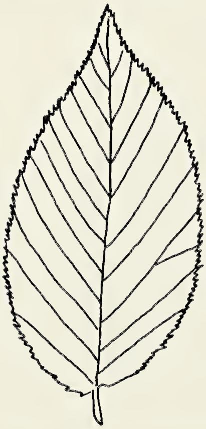


Fig. 49. Hop Hornbeam.

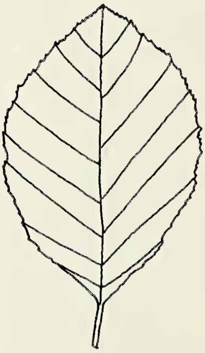


Fig. 50. Witch Hazel.

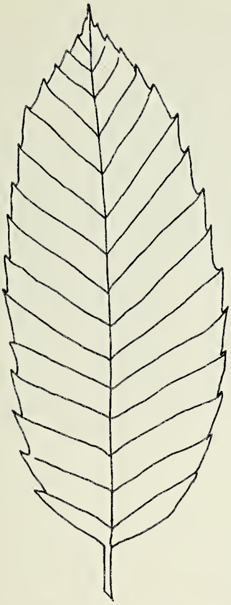


Fig. 51. Chestnut.

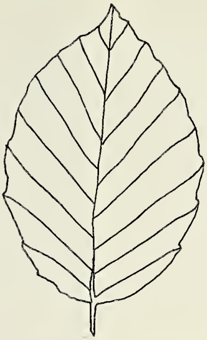


Fig. 52. European Beech.

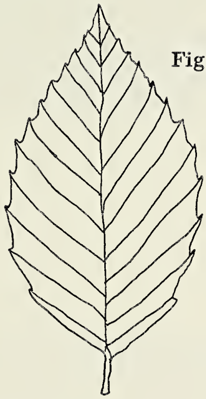


Fig. 53. American Beech.

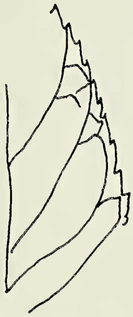


Fig. 54. Veins not ending in Teeth.

25. Leaves usually 5 inches long or longer, and usually more than twice as long as broad (Figure 51). . Chestnuts (*Castanea* sp.).
25. Leaves usually less than 5 inches long, and usually less than twice as long as broad. . . . . Beeches (*Fagus* sp.).
    26. Teeth usually indistinct; leaves with 5–9 pairs of lateral veins (Figure 52); leaves often purple in the summer. . . . . . . European Beech (*Fagus sylvatica*).
    26. Teeth distinct and sharp-pointed; leaves with 9–14 pairs of lateral veins (Figure 53); leaves never purple in the summer. . American Beech (*Fagus grandifolia*).

13. Main lateral veins merging with others or fading out before reaching the margin, not extending into the teeth (Figure 54).
    27. Leaves more than 4 times as long as broad. . . . . Willows (*Salix* sp.).
    27. Leaves less than 4 times as long as broad, usually only 2–3 times as long as broad.

28. Branches with long, slender spines. . . . . Hawthorns (*Crataegus* sp.).
28. Branches without long, slender spines.
    29. Leaf stalks with 1–3 small, dark, roundish or oval structures (glands) near the top (Figure 55); branches and twigs sometimes drooping. . . . . Cherries (*Prunus* sp.).
    29. Leaf stalks without these structures; branches never drooping.
        30. Leaves strongly lop-sided at the base, with the 3 large veins arising directly from the leaf stalk (Figure 56). . . . . Hackberries (*Celtis* sp.).
        30. Leaves not lop-sided at the base, and with only one large vein (the mid-vein) arising directly from the leaf stalk.
            31. Leaves not toothed all the way to the base (usually the lower quarter untoothed); flowers appearing in the summer and resembling those of blueberries or Lily-of-the-valley (Plate 29). . . . . . Sourwood (*Oxydendrum arboreum*).
            31. Leaves toothed to the base or nearly so; flowers appearing in the spring, not resembling those of blueberries or Lily-of-the-valley.
                32. Mature leaves more than 2 inches broad; flowers bell-shaped, hanging downward (Plate 30); fruit with 4 papery wings. . . . . Silverbell (*Halesia carolina*).
                32. Mature leaves less than 2 inches broad; flowers not bell-shaped, more or less upright; fruit without papery wings.
                    33. Leaves heart-shaped at the base. . Shadbushes (*Amelanchier* sp.).
                    33. Leaves rounded or triangular at the base.
                        34. Leaves white, gray, or silvery beneath; flowers in dense pussy-willow-like clusters, appearing before the leaves. . . . Willows (*Salix* sp.).
                        34. Leaves green or rusty beneath; flowers with 5 to many white or pink petals, not in dense clusters, appearing with the leaves. . . . . Apples (*Malus* sp.).

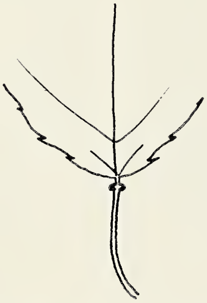


Fig. 55. Glands on the Leaf Stalk of Cherry.

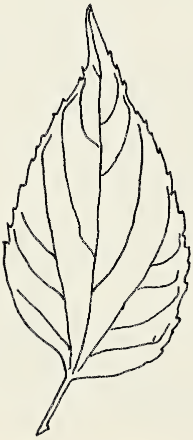


Fig. 56. Hackberry.

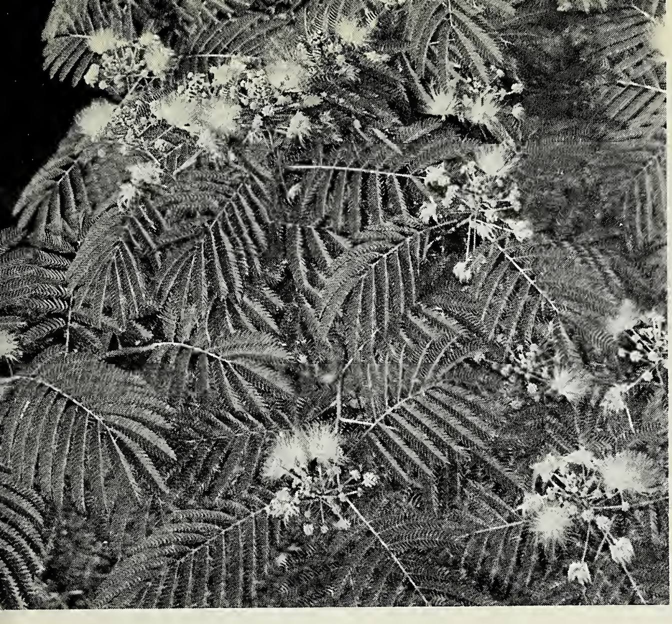


Plate 11.
Silk Tree
(*Albizia julibrissin*)

Plate 12.
Goldenrain
Tree
(*Koelreuteria paniculata*)

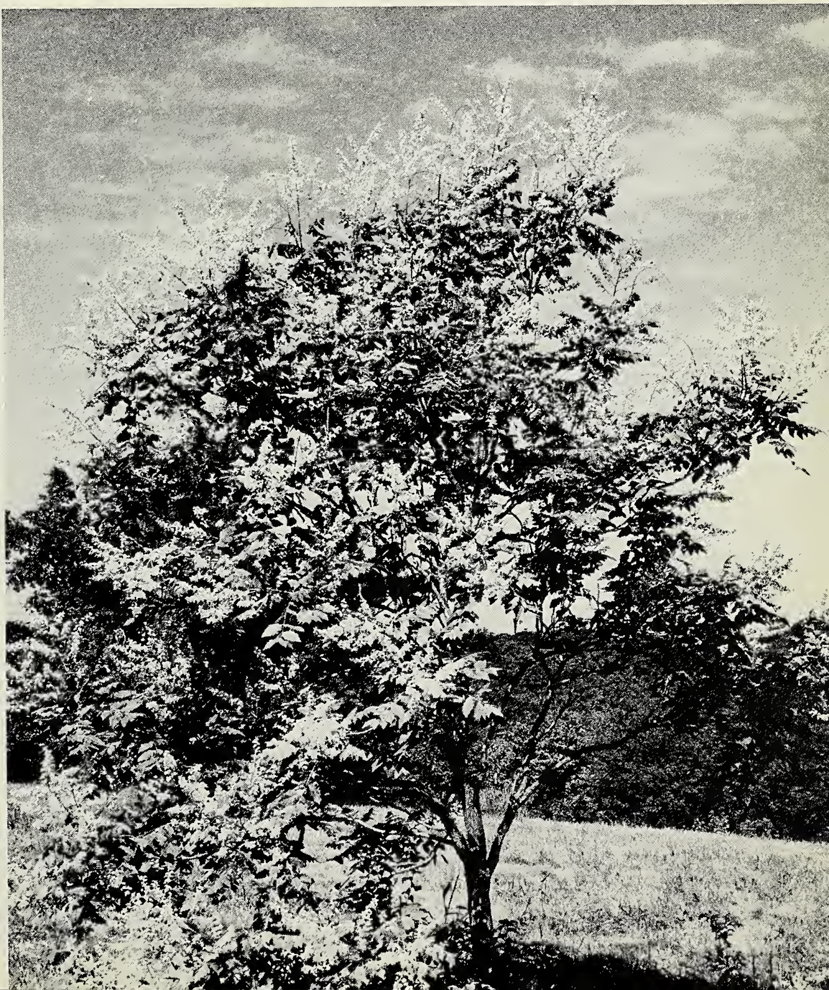


Plate 13. Beautybush (*Kolkwitzia amabilis*)

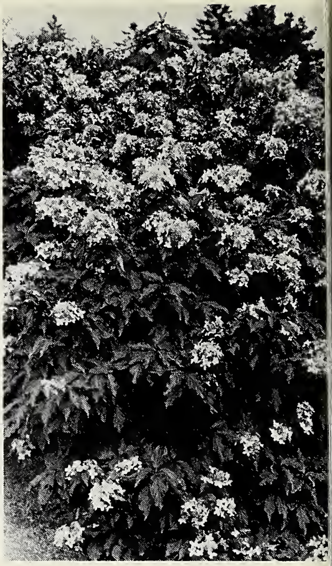


Plate 14.
Panicle Hydrangea
(*Hydrangea paniculata*)

Plate 15. Catalpa
(*Catalpa*)

Plate 16.
Catalpa Fruit

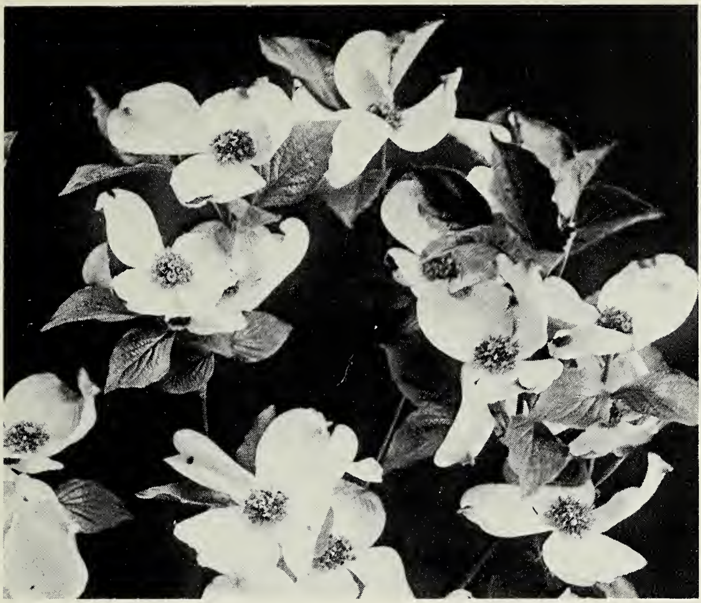
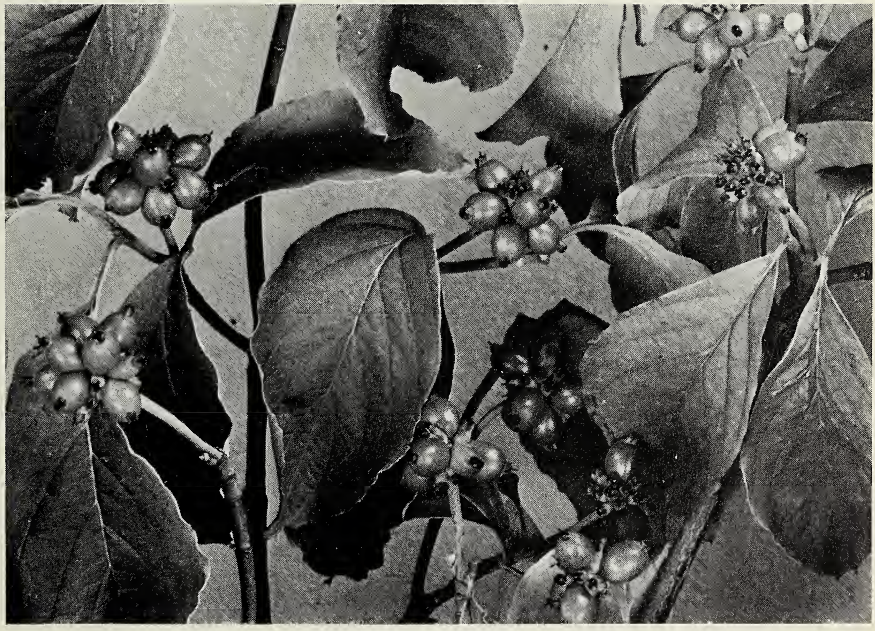


Plate 17. Flowering Dogwood
(*Cornus florida*)

Plate 18. Flowering Dogwood Fruit



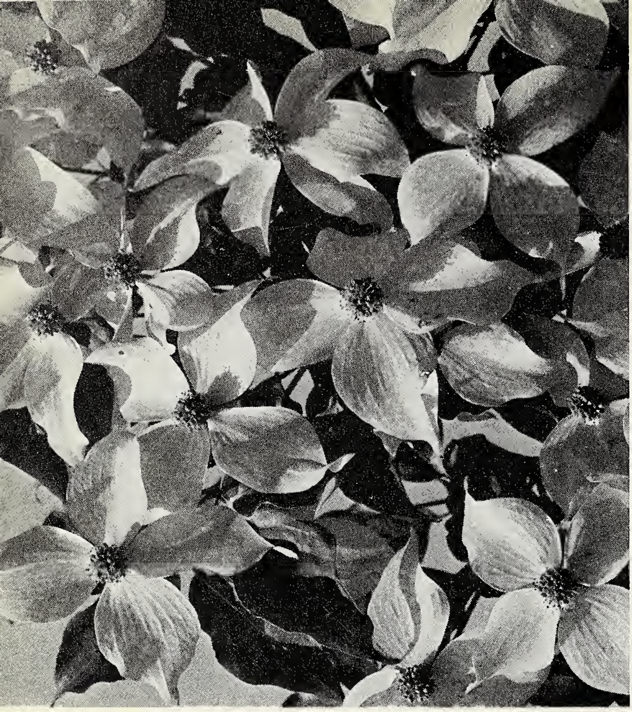


Plate 19. Kousa Dogwood
(*Cornus kousa*)

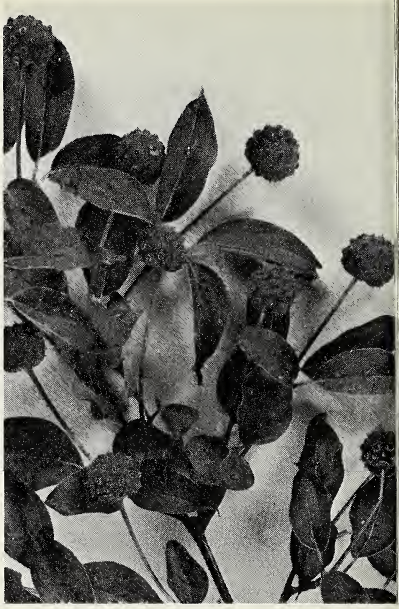
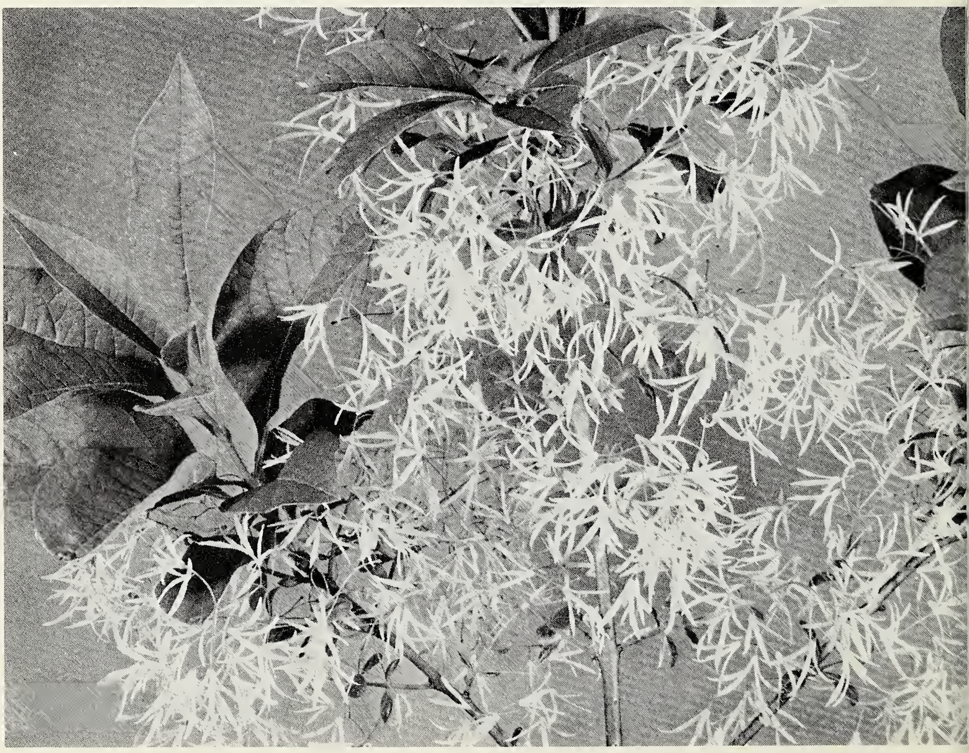


Plate 20. Kousa Dogwood Fruit

Plate 21. White Fringetree (*Chionanthus virginicus*)



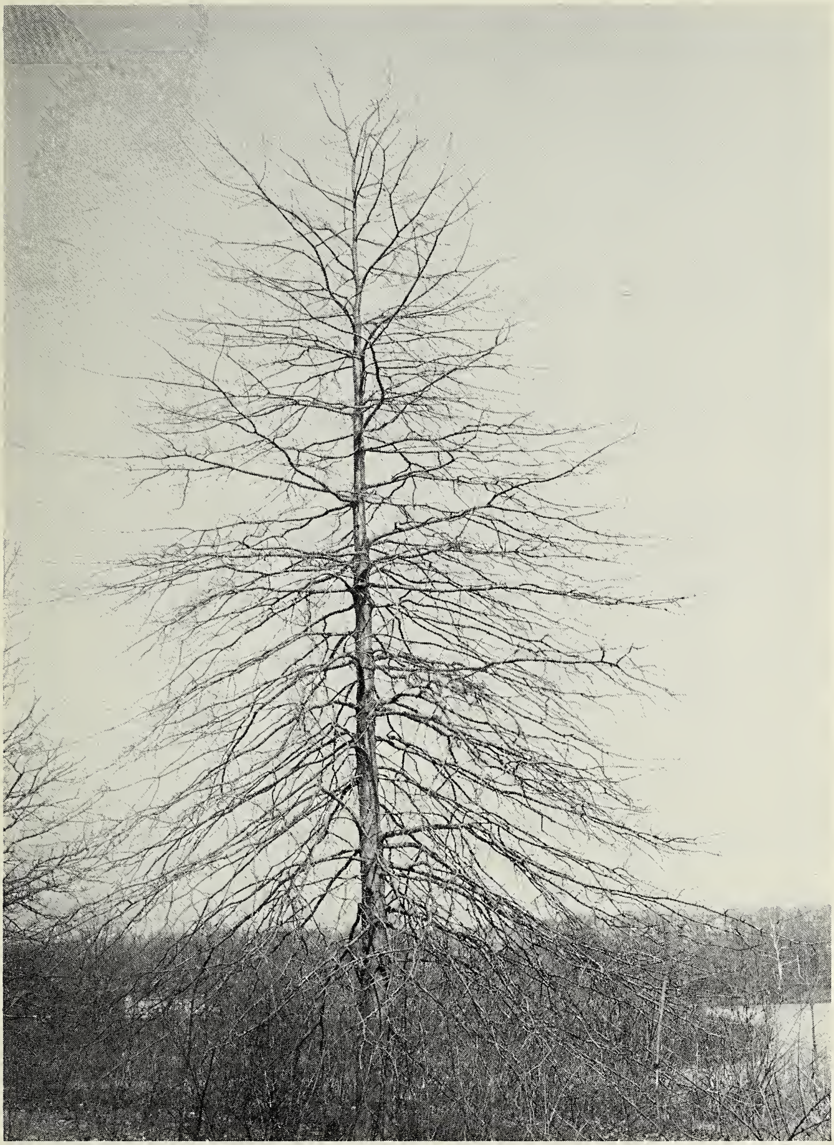


Plate 22. Pin Oak (*Quercus palustris*)

KEY J. LEAVES SIMPLE, ALTERNATE, UNLOBED, WITH ENTIRE MARGINS.

1. Twigs and leaves (especially the undersides) densely covered with silvery scales; leaves usually less than 1/2 inch broad and always less than an inch broad. . . . . Russian Olive (*Eleagnus angustifolia*).
1. Twigs and leaves without silvery scales, although the leaves sometimes whitish beneath; leaves more than an inch broad.
    2. Twigs pleasingly aromatic when bruised; flowers more than an inch across (Plate 31); buds (those enclosing next year's flowers) more than 1/2 inch long (Plate 32). . . . . Magnolias (*Magnolia*).
        3. Leaves distinctly white beneath, half-evergreen; flowers appearing in late spring or early summer. . . . . . . Sweet Bay (*Magnolia virginiana*).
        3. Leaves green or rusty beneath, deciduous; flowers appearing in early spring.
            4. Flowers appearing with or after the leaves; flowers green or yellowish; large trees, to 70 feet tall . . . . Cucumber Tree (*Magnolia acuminata*).
            4. Flowers appearing before the leaves; flowers pink, purple, or white; small trees, not more than 30 feet tall.
                5. Mature leaves more than 8 inches long; buds (those enclosing next year's flowers) not hairy. . . . . Umbrella Magnolia (*Magnolia tripetala*).
                5. Mature leaves less than 8 inches long; buds (those enclosing next year's flowers) densely hairy (Plate 32).
                    6. Leaves less than 2 inches broad; flowers with more than 10 "petals", the "petals" usually 1/2 inch broad or less, and white or pale pink (Plate 31). . . . . Star Magnolia (*Magnolia stellata*).
                    6. Leaves more than 2 inches broad; flowers with less than 10 "petals", the "petals" usually an inch or more broad, pink or purple (at least on the outer or lower surface) or more rarely white.
                        7. "Petals" all about the same length in each flower. . . . . . Yulan Magnolia (*Magnolia denudata*).
                        7. Some "petals" conspicuously shorter than others in the same flower . . . . Saucer Magnolia (*Magnolia × soulangeana*).

2. Twigs not aromatic when bruised; flowers less than 1/2 inch broad; buds (those enclosing next year's flowers) less than 1/2 inch long.
    8. Leaves palmately veined and heart-shaped (Figure 57), flowers pink or purple (rarely white), pea-like (Plate 33); fruits pea- or bean-like. . . . . Redbud (*Cercis* sp.).
    8. Leaves not heart-shaped; flowers greenish or white, not pea-like; fruit not pea- or bean-like.
        9. Margins of leaves with indistinct teeth, or the margins at least wavy; leaves hairy at least along the midvein beneath. . . . . European Beech (*Fagus sylvatica*).
        9. Margins of the leaves without teeth and not wavy; leaves not at all hairy.
            10. Leaves with blunt or rounded tips (Figure 58), sometimes purple in the summer . . . . Smokebush (*Cotinus* sp., *Plate* 34).
            10. Leaves with sharply pointed tips, never purple in the summer.
                11. Leaves usually broadest above the middle; fruits on long slender stalks, blackish, berry-like, less than 1/2 inch in diameter. . . . . Black Gum (*Nyssa sylvatica*).
                11. Leaves broadest at the middle or below; fruit without a stalk or on a very short one, orange, very juicy when ripe, more than 1/2 inch in diameter . . . . Persimmon (*Diospyros virginiana*).

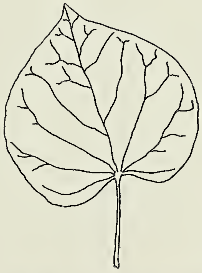


Fig. 57. Redbud.

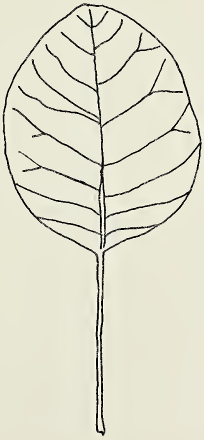


Fig. 58. Smokebush.

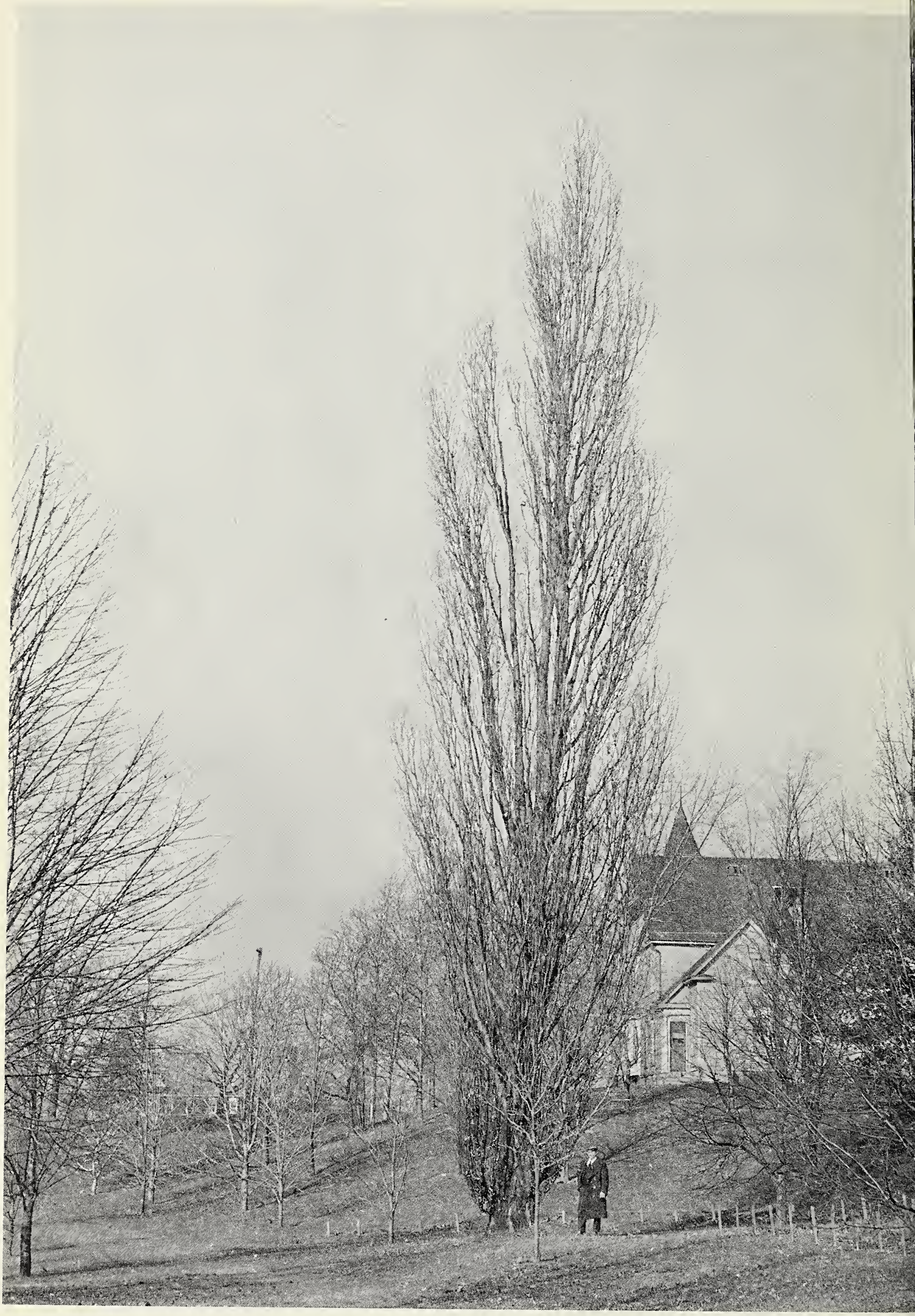


Plate 23. Lombardy Poplar (*Populus nigra*)

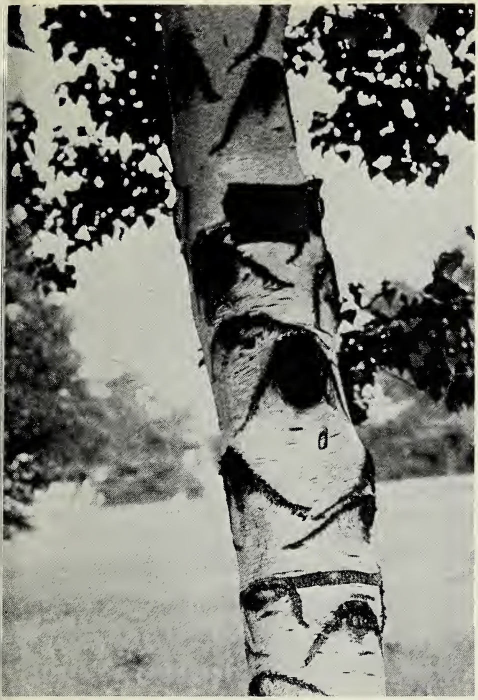


Plate 24.
Birch (*Betula*)

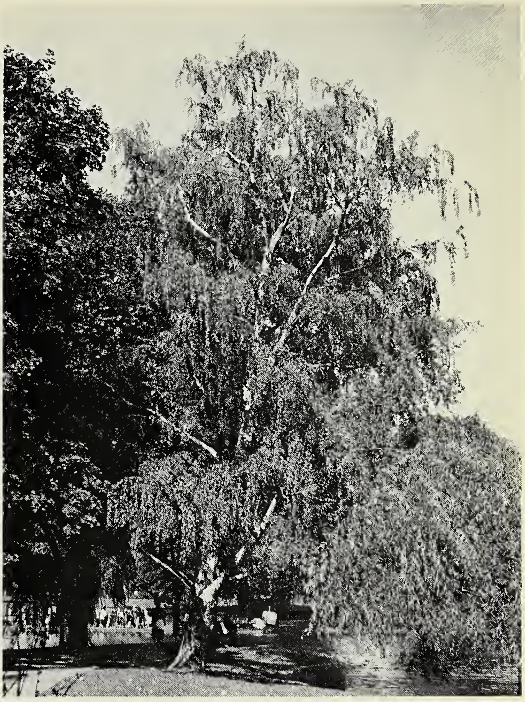


Plate 25.
European Weeping Birch
(*Betula pendula*)

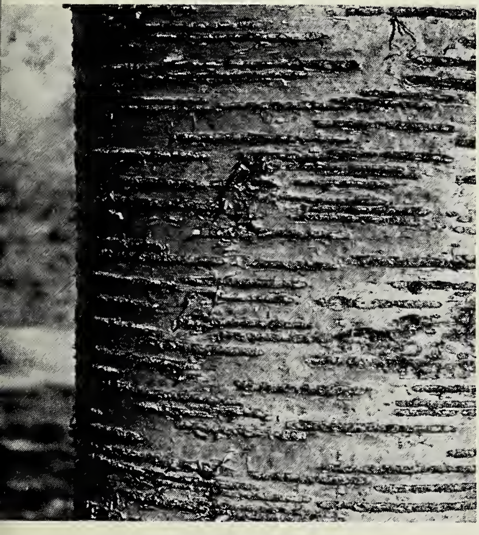


Plate 26. Yellow Birch
(*Betula lutea*)

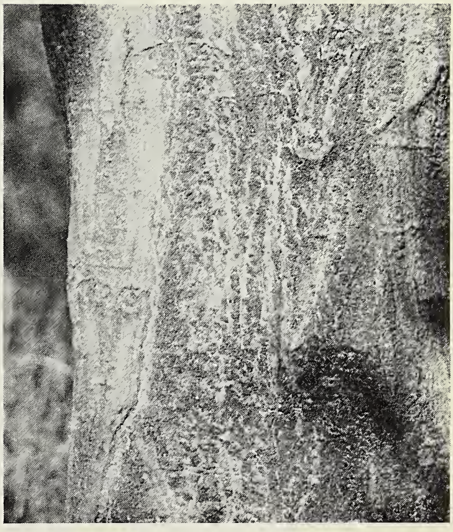


Plate 27. Hornbeam
(*Carpinus*)

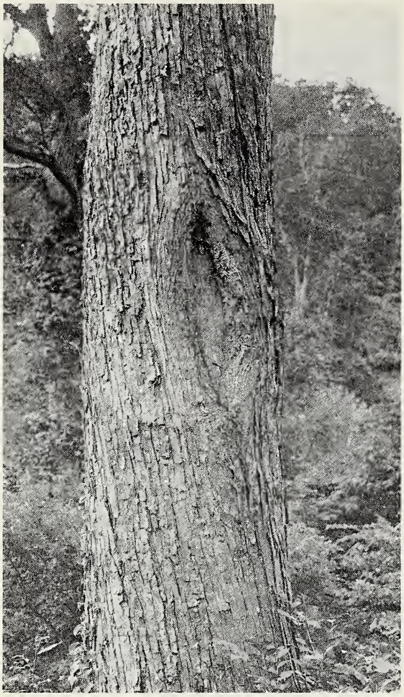
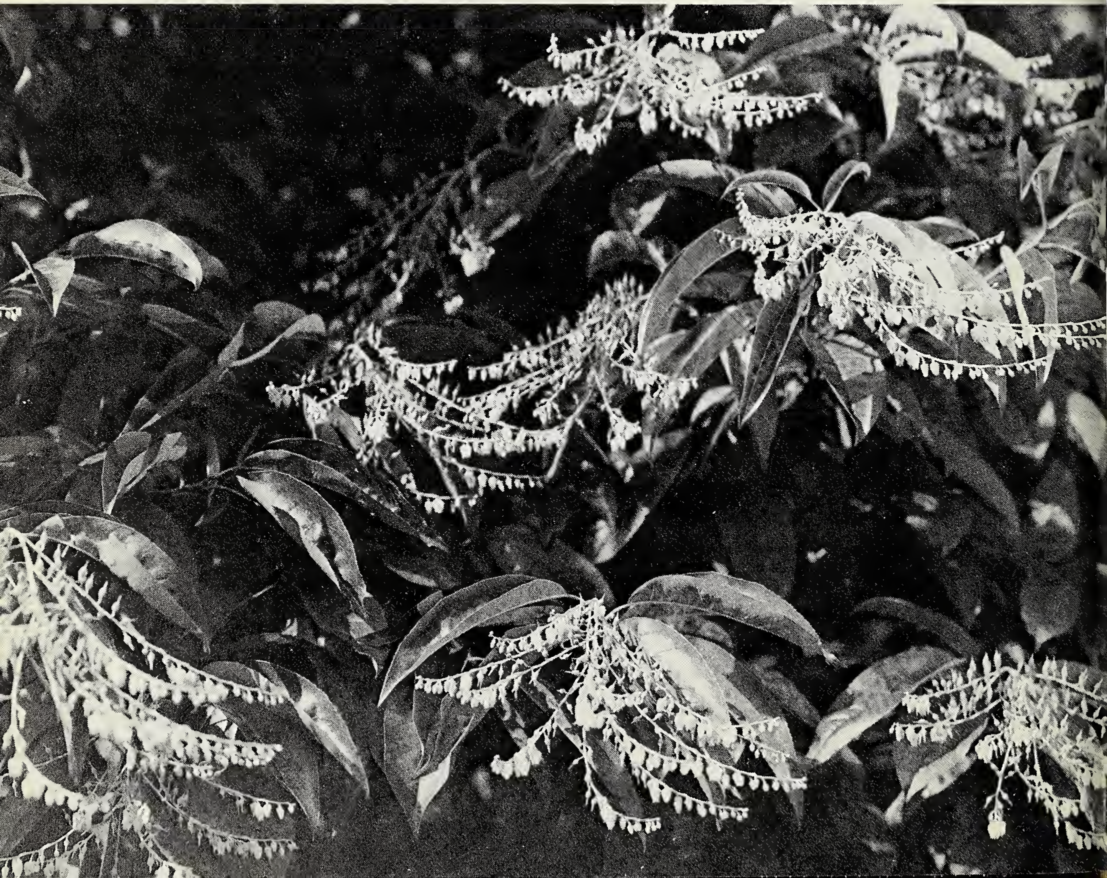


Plate 28.
Hop Hornbeam
(*Ostrya*)

Plate 29. Sourwood (*Oxydendrum arboreum*



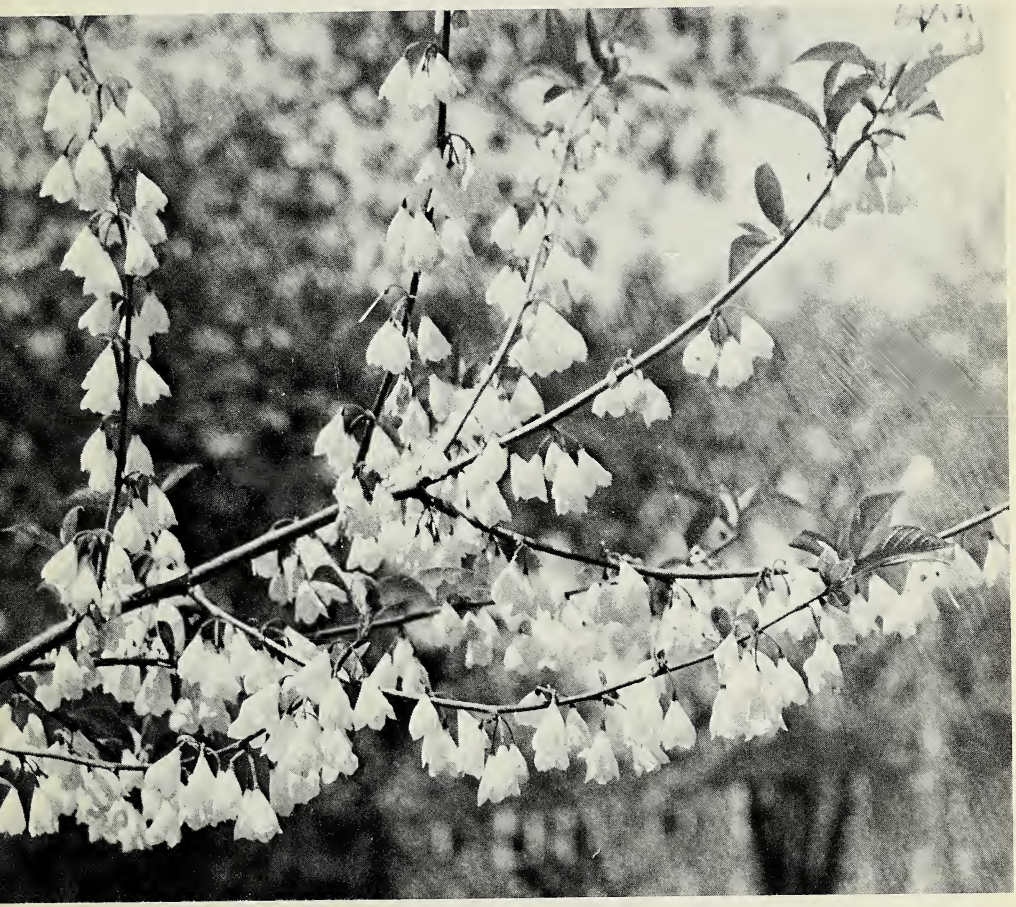


Plate 30. Silverbell
(*Halesia*)

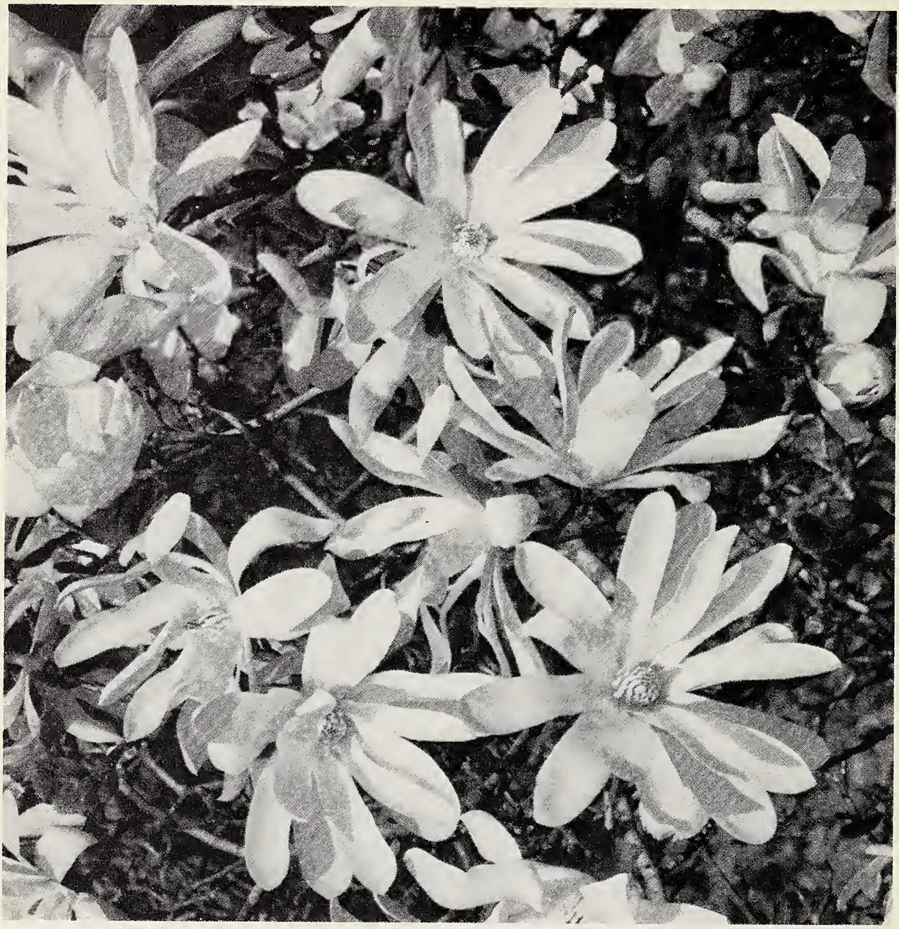


Plate 31. Star Magnolia (*Magnolia stellata*)

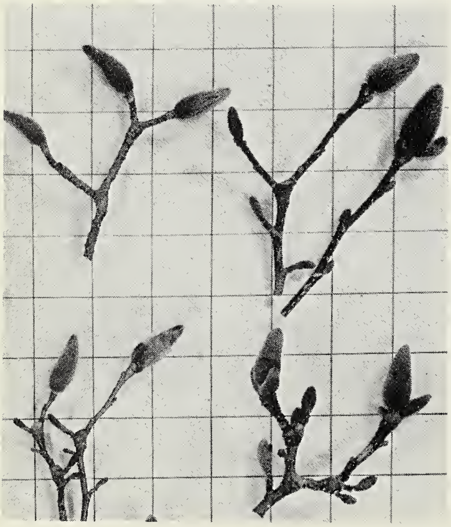


Plate 32.
Magnolia buds

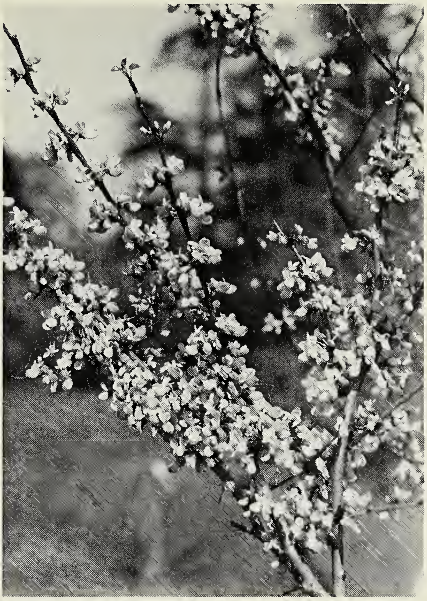


Plate 33. Redbud (*Cercis*)

Plate 34. Smokebush (*Cotinus*)

Arnoldia in the kitchen

Persimmon Pudding *

The wild American persimmon, *Diospyros virginiana*, is found over a wide area from Cape Cod to Central Florida and west to Kansas and Texas. The sexes are usually on separate trees, but some cultivars have been developed which have a few male flowers on the female tree and a few female flowers on the male tree so they can self pollinate. A species from the Orient with larger fruits, *D. kaki*, can be grown in southern United States.

The yellow-orange fruits are delicious when ripe. Often the wild fruits do not ripen until after a frost, but individual trees vary. Among the cultivars are some which ripen as early as mid August and September. When it is ripe the Persimmon fruit is very soft, with a distinctive pleasing flavor.

1 quart ripe persimmons
1/2 cup butter
1 cup sugar
1 cup milk
2 eggs well beaten
2 cups sifted flour
1/2 teaspoon salt
1 teaspoon baking soda
1 teaspoon vanilla

Peel and pit persimmons and rub through a sieve. There should be two cups of pulp. Preheat the oven to 325°. Cream the butter until very soft and gradually stir in the sugar, beating until the mixture is light and fluffy. Add the persimmon pulp, milk, and well-beaten eggs. Beat well. Sift flour with

* Recipe from The Tuesday Soul Food Cookbook, copyright © 1969 by Tuesday Publications, Inc. By permission of Bantam Books, Inc.

salt and soda, add to persimmon mixture, and beat well. Butter a large loaf pan generously, and line bottom with brown paper. Pour in the batter and bake 1 1/2 hours at 325°. Serve warm, with whipped cream if desired. Serves 8.

Arnoldia Reviews

West Australian Native Plants in Cultivation, by A. R. Fairall

Anyone who becomes interested in knowing more about the showy and unfamiliar Australian plants we may have seen at flower shows or growing in the warmest parts of the United States soon discovers that many of these are natives of Western Australia. This is the largest of the six Australian states, including a third of the continent, a great diversity of floristic types, and, in the southwestern corner of the state, an area of the greatest botanical interest and importance. Draw a line from Shark Bay on the western coast of the state southeastward to a point between Albany and Esperance on the southern coast and you have marked off the Southwestern Floristic Province, an area noteworthy both for a high degree of endemism (there are more than 100 genera restricted to this area) and for a remarkable degree of speciation in many groups — nearly 500 species of Myrtaceae and about 450 species of Proteaceae. Australians, and Western Australians, in particular, who care about plants are understandably proud of this flora, but also have been concerned by the use — or the mis-use — which has been made of the area in which it occurs. In 1962 a group of interested botanists and horticulturists started, on a site overlooking the Swan River in Perth, a botanic garden devoted to native plants, with the goals of learning how best to grow them and of arousing more public interest in their preservation and use as horticultural subjects. Many Australians, I might mention, have a regrettable tendency to dismiss the handsome *Callistemon* growing by the roadside as "just a bottlebrush," while at the same time wasting their horticultural energies on growing petunias and pelargoniums under the most unsuitable conditions. From its foundation the superintendent of this garden, now world-famous as King's Park, has been Arthur Fairall who, in this book, has produced the definitive work on the cultivation of west Australian plants.

Mr. Fairall begins with a general introduction to Western Australia and its flora and provides a section discussing the horticultural practices followed at King's Park. Then follow 200 pages of data on plants in cultivation there, all of these native to Western Australia, although not all from the Southwestern Province. The genera, and within them, the species, are arranged in alphabetical order, and for each species comments are provided on the plants themselves, on flowering times (remember that December and January are mid-summer months in Australia), and on the conditions of soil and shade most favorable for their growth. In addition, and perhaps best of all, of the 650-odd species discussed, 106 are illustrated in color photographs, often of full-page size. To judge from the species I have seen in the field, the quality of the color reproduction is very good. The following comment is mere cavilling, but I do wish there could have been a full page photo of the Christmas Tree (*Nuytsia floribunda*), a large arborescent mistletoe which in November and December is laden with huge heads of orange-yellow flowers. To see *Nuytsia* in full flower is worth the trip to Western Australia.

For most of us who do not live in southern California or Florida Mr. Fairall's book can, I fear, only whet our appetite for the unattainable, for the perennial species cannot cope with our northern winters. However, some of the annual species might repay attention and the magnificent leguminous herb *Clianthus formosus*, Sturt's Desert Pea, can be grown in the greenhouse. It germinates quickly and grows rapidly with most rewarding results. For those who might wish to know more about the cultural requirements of these plants and of those from other parts of Australia, I would recommend the bulletin of the Society for Growing Australian Plants (SGAP).

But even if we cannot grow any of these plants, I think that Mr. Fairall's book is still worth having. It is nicely bound and printed and, for me, the illustrations alone would be worth the price.

E. A. S.

A. R. Fairall, West Australian Native Plants in Cultivation. Pergamon Press, 1970. 253 pages and 105 color photographs. $14.50.

Right: Ranunculus ficaria *var.* bulbifera
along Indian Spring in the Arnold Arboretum.
Photo: P. Bruns

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ARNOLDIA

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Contents

103 E. H. Wilson's First Trip to China
WILLIAM GARDENER

115 Gardening Books for Libraries
GORDON P. DE WOLF

126 One Hundred Years of Apples
M. B. HOFFMAN

133 The Rochester Strain of Lilacs
ROBERT B. CLARK

136 Weeds: A Link with the Past
Bouncing Bet
HELEN ROCA-GARCIA

138 Arnoldia Reviews

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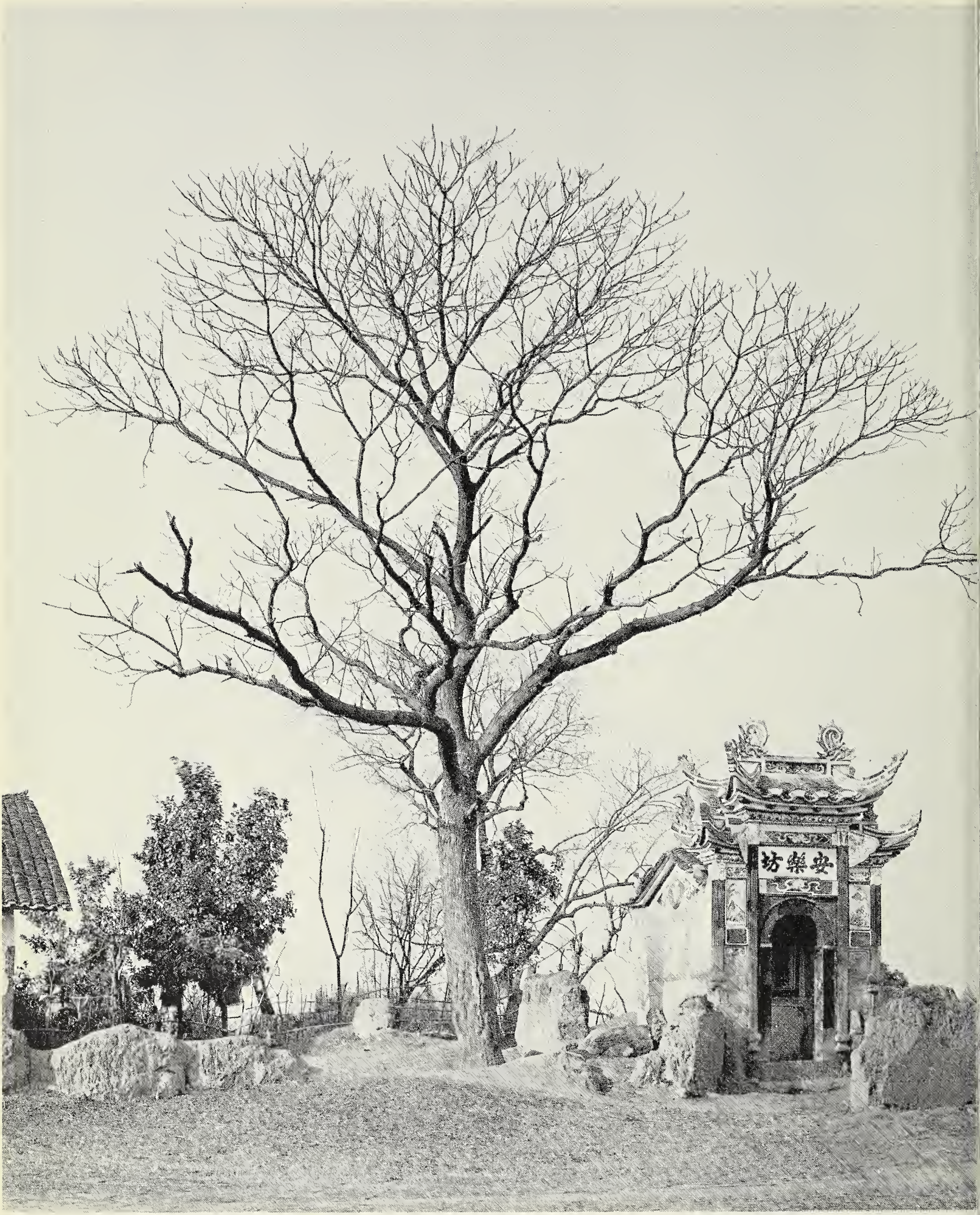
Cover: Davidia involucrata. *Drawing by P. Bruns*

ARNOLD ARBORETUM
1872·CENTENNIAL·1972

Cornus kousa, *var.* chinensis *in the Arnold Arboretum. This plant was collected by E. H. Wilson during the Arnold Arboretum Expedition to China in 1910.*



Tree (Melia azedarach) *and shrine. Ichang, Western Hupeh.*
Photo E. H. Wilson, 1907–09.

E. H. WILSON'S FIRST TRIP TO CHINA

Davidia involucrata, the Dove Tree, is a plant which has captured the imagination of the gardening public as few other plants have. It was originally discovered in 1869 by Abbé Armand David, a French missionary travelling in China. Abbé David found it "near Moupine, Western China . . . . growing at an elevation of between 6,000 and 7,000 feet." The Abbé sent dried herbarium specimens to Paris and it was described as a new genus and species by Henri Baillon in 1871. In that same year a leaf and a bract were sent to the herbarium at the Royal Botanic Gardens at Kew.

In 1889 Dr. Augustine Henry found a single tree in the South Wushan district of Szechuen. From this he collected both flowering and fruiting specimens for the herbarium at Kew. This was illustrated and discussed by Dr. Daniel Oliver, Keeper of the Herbarium and Library at Kew. Oliver commented at the end of his description "*Davidia* is a tree almost deserving a special mission to Western China with a view to its introduction to European gardens. . . ."

M. Maurice de Vilmorin, of the famous French nursery firm of the same name, was much taken by the newly described plant and asked his correspondents in China to be on the look-out for it. In June of 1897 Vilmorin received a shipment of 37 fruits, collected by Père Farges, another missionary, in Se-tchwen (Szechuen). The next year Farges sent 3 fruits collected in "Eastern Tibet" or Moupine.

Of the 40 fruits only one from the first shipment germinated in 1899 two years after sowing. In 1901 Vilmorin made four cuttings and layered a branch. Only two of the cuttings survived one going to the Jardin des Plantes in Paris, the other to the Royal Botanic Gardens, Kew. The layer was sent to Professor Sargent at the Arnold Arboretum in 1904 and is still thriving. In 1906 this original plant in Vilmorin's nursery produced its first flowers, only 7 years after germination.

G. P. DeW.

When E. H. Wilson was sent to China in 1899 by the nursery firm of James Veitch and Sons to collect the seeds of *Davidia involucrata,** he was instructed by them to consult the botanist Augustine Henry as to the exact location of this tree. Henry's enthusiasm for the flowering of the tree had been caught by his correspondent Sir William Thistleton-Dyer (1) at Kew and spilled over to the people in the nursery firm. Evidently the tree was as rare as it was beautiful. Also, as it grew in the mountains of Central China, it was likely to take kindly to the climate in an English garden. James Veitch & Sons had financed many profitable journeys to obtain and introduce new plants. Henry's find would recoup another.

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* "In the spring of 1899 Sir William Thistleton-Dyer of Kew was kind enough to select a young man from the staff of the Royal Garden

The Davidia that Wilson was to seek grew in hilly forested tracts where the Chinese provinces of Szechuen and Hupeh meet, on the northern side of the last awe-inspiring gorges of the Yangtze river. Henry had seen only a single specimen (2) in the course of his several expeditions from the neighbouring port of Ichang into an extensive area of mountain and valley, along the right bank of the Han river. This area is often held to be the richest of China's wild gardens. Henry had been able to make extensive botanical explorations there, the first westerner to do so on this scale, thanks to generous allocations of leave from his employment as port medical officer and Indoor (i.e. administrative) assistant in the Customs establishment at Ichang. It may be of interest to mention here that among Henry's contemporaries in this Service were the historian Hosea B. Morse and the sinologue Dr. F. Hirth, men of international reputation, and — by reason of birth and nationality in the one case, and of professional residence in the other — of special significance in the United States.

Ichang, nearly a thousand miles by river-steamer above Shanghai, was the only possible base for a plant-collector operating along the Middle Yangtze, where Wilson could find an expert guide and counsellor at his elbow whenever he returned from the field.

However, Henry had found his Davidia in 1889, and within a few years he had left Ichang on a series of official transfers which brought him ultimately to Mengtsz, a town in southern Yunnan, situated just east of the Red River and near the Tongking (now North Vietnam) frontier. It was reached at that time only by steamer to Haiphong, then by launch up the trade route of the Red River (vessels that became progressively less comfortable as the one-time bandit stronghold of Manhao, at the head of cargo-boat navigation, was neared), and finally, at

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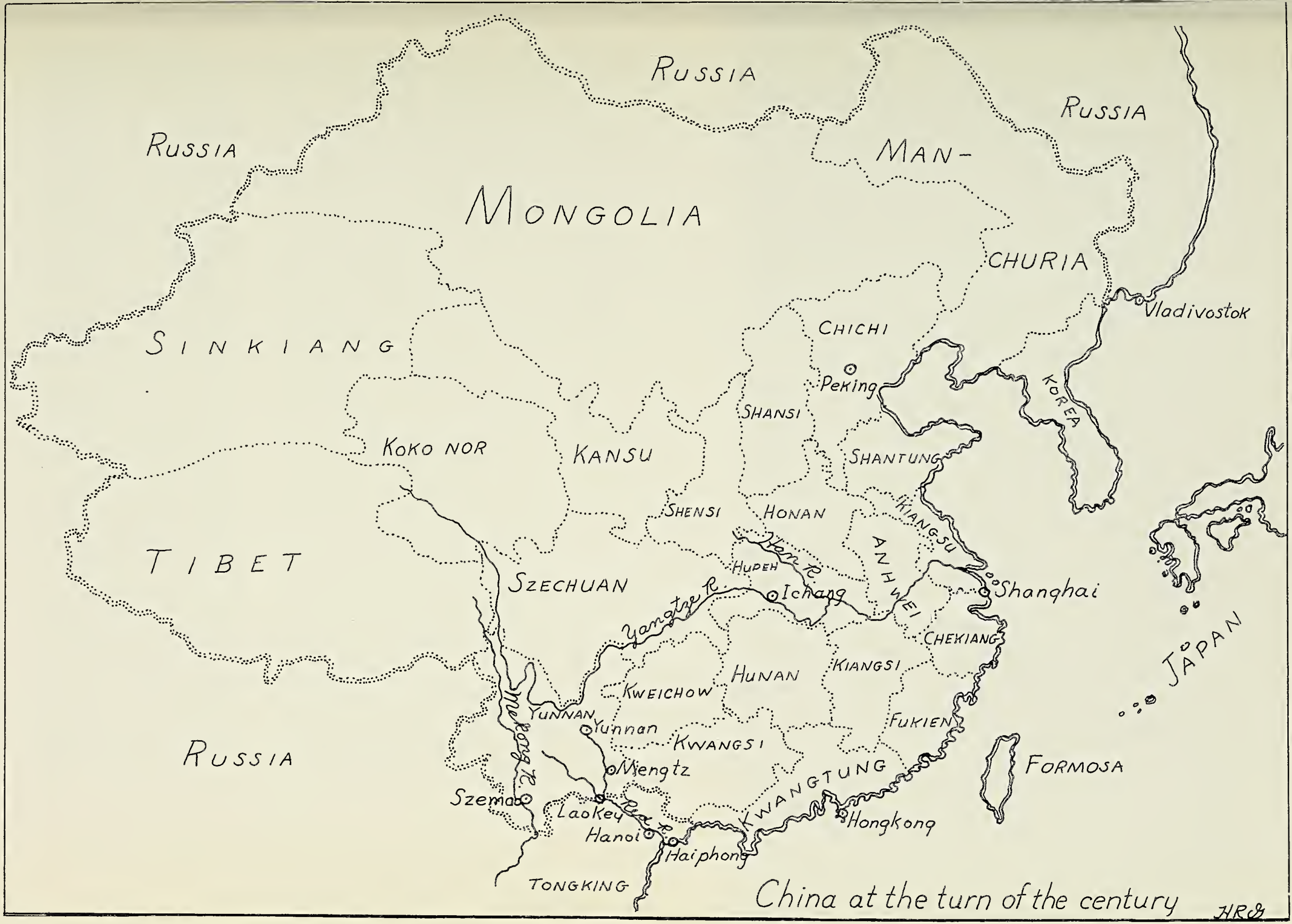
who possessed, as far as could be judged, the necessary qualifications for undertaking a prolonged journey in certain districts of China." (3)

"E. H. Wilson, . . . , was born in Birmingham, and received part of his early training in botany and horticulture in the Botanic Gardens of that town. . . He afterwards entered the Royal Gardens at Kew as a young gardener, and when an application was made to Sir W. T. Thistleton-Dyer, the late Director of the Gardens, for a man likely to prove suitable to undertake a prolonged journey to China, the late Director suggested Wilson for the post." (5)



China at the turn of the century

the frontier itself, by pack-road for four days over the mountains, by mule-back, pony-back, mountain-chair, or one's own feet.

But in January 1898, when Veitch was considering his plans, Henry was off to Szemao in the far south-west of the province, as Commissioner of Customs there. Send your man on to Szemao for a talk, was the gist of Henry's advice to Veitch, — quicker than letters and cheaper than telegrams.

A less committed traveller than Henry, and yet one having some knowledge of the country, might have taken a less lighthearted view. If Mengtz was not easily accessible, the Shan states of the remote border with Laos whereon Szemao lies were even less so.

For Veitch, the hunt for Davidia was taking on the excitement and the twists and turns of a detective chase. He had the faith that derives from zeal supported by topical ignorance, and the expectation, based on past form in other expeditions, that the rewards would amply cover the costs of whatever detours were suggested. So in the spring of 1899 Wilson, his 23rd birthday just passed, set out from England, immediate destination Szemao.

Wilson went to China by way of Boston, Mass.,* where he stopped off for a few days to call on the Director of the Arnold Arboretum. Though C. S. Sargent was to play a major part in Wilson's later life, he comes into this story because he was already a friend of Augustine Henry's, in close and continuous correspondence with him on botanical matters, and much interested in the flora of southern Yunnan. He was thus an early and direct link with the man Wilson was on his way to see.

To reach Szemao in those days (and indeed until aeroplane and helicopter and roadmakers could change the nature of travel), the overland part of the journey really began at Mengtsz. Wilson made good time as far as the Tongking frontier with Yunnan, on the Red River. There he stuck. Surveys for the railway from Hanoi to Yunnan had been in progress, and antiforeign feeling had been sparked off. There had been riots

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* "Wilson sailed from Liverpool in April 1899. Traveling by way of America, he visited Professor Sargent, the well-known authority on ligneous plants at Boston, and consulted him respecting the trees and shrubs likely to be found in China.

"The information obtained, Wilson proceeded, and arrived at Hong Kong on June 3rd, 1899.

"Before leaving for the interior it was considered advisable that Wilson should consult Dr. Henry and benefit by his unrivaled knowledge of the Chinese flora." (5)

Town of Ichang Fu. Photo E. H. Wilson 1907–09.

in Mengtsz, and foreigners' houses had been burnt. Wilson was lucky not to have reached the frontier a week earlier. He might then have met the blast while in the mountains, and his first journey could have been his last. So he sat things out in the French frontier post of Laokay, the 'Old Market', hot, feverous, and rumour-rife, and after a couple of months the usual calm after storm permitted him to go on to Mengtsz. His employer was to write later that "The journey to Szemao *via* Tonkin proved arduous, and at one time the chance of reaching Dr. Henry by this route seemed hopeless; but the steadfast purpose of the young Kew student, of which on this as on other occasions he gave ample proof, enabled him to reach his destination." (3)

At Mengtsz Wilson had the help of Henry's colleagues in the Customs, in hiring muleteers, engaging a cook, and making other arrangements, and was able to leave the place on the 8th of September. The road from Mengtsz to Szemao runs westward through the tropical south of the province. During the 70 years or so in which Europeans and Americans might travel along it, it involved a journey at caravan pace, and no wheeled traffic; up one range and down another, and over spurs that seemed to run in any direction; with the Red River and the Black River and some lesser waters to cross, and mules to carry the baggage and the cooking gear. The average speed was two to two-and-a-half miles an hour, for seven or eight hours a day, and the voyage might last seventeen or eighteen days, perhaps marginally less if the traveller were experienced enough to dominate his muleteers. Altitudes along the road range from a few hundred feet above sea level at the Red River near the Tongking border, to about 7,500 feet over the Mekong-Black River divide. Hence the flora, in the usual south-west Yunnan switch-back, swings between the tropical and the temperate. Orchids provide some colour, in forests which are less flamboyant than the Indian equivalent. Monsoon rainfall is heavy, and ferns are numerous. Leopards, monkeys, barking-deer, and elephants in the remoter depths, are among the larger animals. Yunnan is a thinly-populated province, wherein the Chinese are the latest-comers, and live in the small towns, and terrace the hill-sides for rice, at the medium altitudes. The higher ridges and the depths of the forests are the haunts of various separate peoples of Mongoloid descent, hunters mostly, who practise also the primitive agriculture of burn, plant, reap and move on. The more numerous Shans, or Thais, who once ruled Yunnan, live as peaceably as they may in the lower valleys, growing rice and worshipping Buddha.

Wilson did the journey in seventeen days. Daylight was perhaps more agreeable than dark, for the night's accommodations were found in dirty Chinese inns or a tribesman's hut. He could, in fact, have saved that leg of the journey. For when he arrived in Szemao, he found that Henry, although still there, had been transferred again, by a telegram re-appointing him to Mengtsz. The two travelled back there in company, for Wilson at last to make for Ichang, and reach the town on the 28th of February, 1900, nearly a year after leaving England.

From Mengtsz, in early November, one successful garden plant went to England. In his *Aristocrats of the Garden* (4) Wilson remarks "During my journeys in Yunnan I collected a number of interesting plants and among them *Jasminum primulinum* which has achieved widespread popularity in Europe and in this country". Veitch was proud of the acquisition, which he states (5) that Wilson collected "upon his return from Szemao". The handsome 2-inch clear yellow blossoms won it a First-class Certificate from the Royal Horticultural Society in 1903. (6) It was described and illustrated in the *Gardeners Chronicle* (7), and in Curtis's *Botanical Magazine*. (8)

Wilson's other plants from Yunnan did not much interest Veitch. There is no mention of them in *Hortus Veitchii*, nor in his notes of 1902 on *Recently Introduced Trees, Shrubs, etc. from Central China*, published in Journal No. 28 of the Royal Horticultural Society. They appear to have passed out of record. Their despatch may have owed something to Henry. Clearly the collection of the jasmine did. Henry had found it near Szemao, as well as in the vicinity of Mengtsz, where another botanist, William Hancock (1847–1914), like Henry an official in the Chinese Imperial Maritime Customs Service, had found it a few years before. Henry regarded it as an escape from cultivation.* The name given to it when Hancock sent the first specimens from Yunnan masks an earlier finding still. In April 1880 one of Dr. J. F. Hance's band of amateur collectors, W. Mesny, discovered it in the province of Kweichow, which adjoins Yunnan on the north-east. Hance published it in the *Journal of Botany* (vol. xx, p. 367) under the name *Jasminum Mesnyi*, Hance. When the first Mengtsz specimen was sent to Kew by W. Hancock it was described in Hooker's *Icones Plantarum* (4th Ser. Vol. IV, pl. 2384, 1895) as *Jasminum primulinum* Hemsl. Since that time either name has been in use.

Few westerners had been to Szemao before Wilson. After exploration of the lower Mekong had brought the Francis Garnier expedition to Yunnan, in 1867, some of its members had gone eastwards from Szemao to the Red River. Subsequently, there had been perhaps a score of western travellers, and all within the couple of decades preceding Wilson's journey. Their routes had varied slightly. Interests, and the time available to pursue them, had varied more. But each traveller, whether an army officer surveying for the dream of a Burma-Yunnan railway, a customs official proceeding on duty, or a missionary priest, was in a country of which little was known to the west, which the wheel age had not yet overtaken, and of which published personal impressions of its great attractions were few. Yet Wilson's description of this his first and very considerable journey, is confined, so far as I can discover, to one remark:

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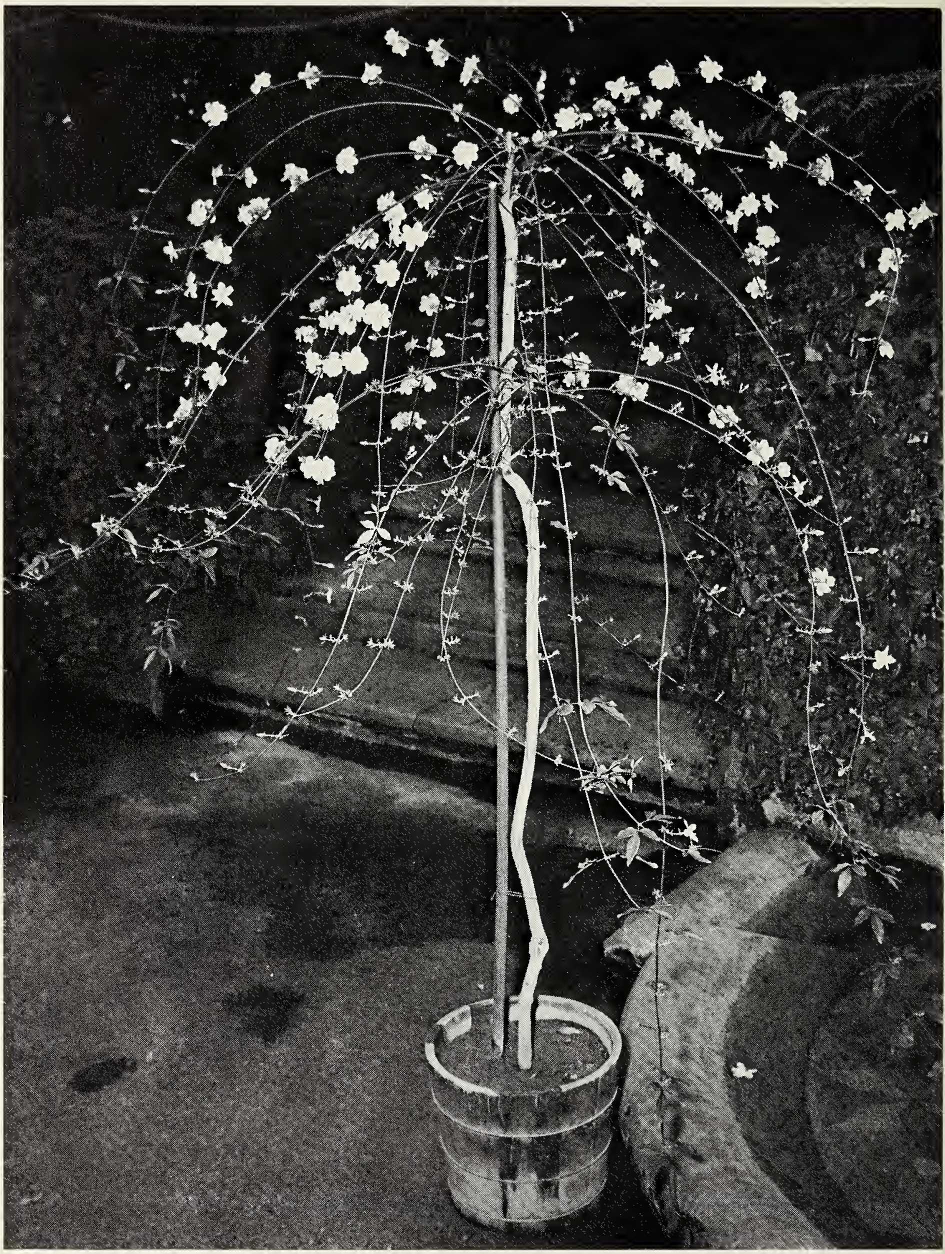
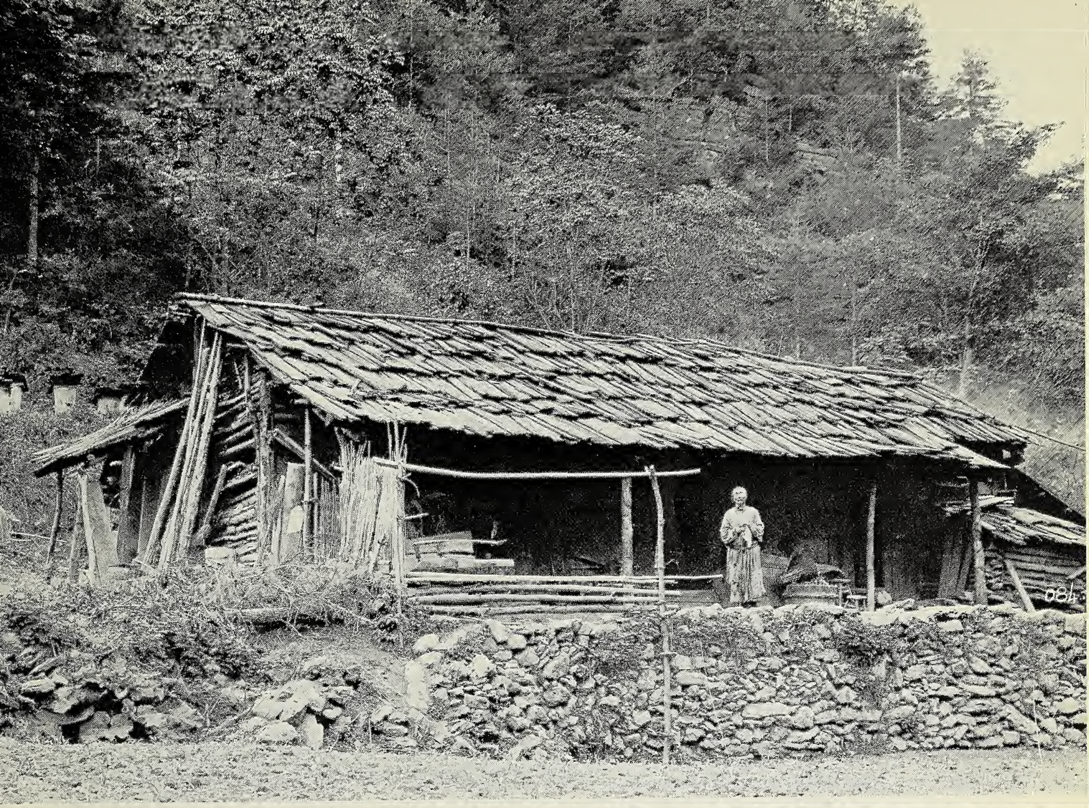
* Although Wilson first sent back living plants, Augustine Henry had collected herbarium material for Kew earlier. Henry commented about the plant as follows: "I found the plant both at Szemao and Mengtsz, in the Province of Yunnan; but I am of opinion that it occurs always, in the districts where it has hitherto been found growing cultivated or as an escape from cultivation. The shrubs were seen in gardens, or more frequently in hedges or amidst other shrubs, in the vicinity of villages, and never were met within woods or forests." Botanical Magazine, Vol. 130, 1904.



Above: Jasminum mesneyi. *Longwood Gardens photo.*

Right: *Cargo boat of 60 tons, built almost entirely of Cypress wood. Yangtsze River, Western Hupeh. Photo E. H. Wilson, 1910–11.*



Hostel of Che-tsze-kow. Western Hupeh.
Photo E. H. Wilson 1910–11.

"Being unable to speak any Chinese, I travelled very much as a parcel and enjoyed the trip." (9)

Species brought back from the wilds have usually been collected arduously, sometimes in conditions of physical danger, and always under an eye trained to discern the potentially useful or delightful. Though the tracks the collector went by are unexplored, or have remained unfamiliar, it is no part of the bargain that he should describe them.

Well, Wilson's pen on subsequent trips left records of sacred mountains in Szechuen, and of the ranges and river-valleys along the Tibetan border, and of much else that took his fancy during his travels in the provinces immediately north of the Yangtze. Ignorance of the Chinese language — for he never did learn it — was no bar there. But on Yunnan, with all its romantic appeal, there was near silence. I find that a puzzle, and am teased by it.

Admittedly, September is a little early for the best sightseeing. The tracks have not then fully recovered from the summer monsoon, and a curtain of rain is still a possibility. (Indeed, had Wilson not been delayed at Laokay, he might have set out sooner and then fared worse.) Yunnan must have offered a bewilderingly strange first taste of the interior of China, to this young man of 23. The interpretative powers of his servant, more likely to have been based on *petit-négre* French than on pidgin-English, were not likely to illuminate, say, the distinctions between the several tribes encountered, and their customs, or the sudden sounds in the usually silent and empty-seeming forests through which the caravan passed, or the niceties of such manoeuvres as a river-crossing by ferry, and negotiation of a crumbling cliff-edge track, when conducted at the top of many voices at once. His instructions were to press on to meet Henry, and then locate Davidia. Tropical flora did not interest Veitch much, — and Henry rather less. (10) Orchids were out.

Yet neither strangeness nor haste seem adequate as explanations. I observe that Wilson's habit was to publish nothing in a hurry. Only on his second visit to China (to find *Meconopsis integrifolia*) did he start contributing regularly to the periodical press. His book describing his journeys, "A *Naturalist in Western China*", is an amalgam of all four visits to the country, those for Veitch and those for the Arnold Arboretum. Perhaps it was knowledge that interested him even more than impressions; and his relative ignorance of the Yunnan in which he spent three months silenced him.

None of the flora along his way there had had more than casual sampling. Even today this is, botanically speaking, the least explored segment of Yunnan — unless the hills of the Wa head-hunters now count as part of the province. The divides which the Mengtsz-Szemao route crosses, one of them high enough to receive snow in winter, contain what are probably the most southerly stations of some of the robust species of the eastern Himalaya, and, for good measure, the location of a genuine *wild* tea plant. (11) They may concern the plant geographer more than the horticulturist's plant-collector; for it may be taken for granted that they are less rich in the number of asters and deutzias, gentians and lilies, and primulas and rhododendrons, than the mountains further north. Yet to the traveller with a road to pass along, and little opportunity to linger off it, the species that will be visible are a matter of the luck of the time of the journey, and of proximity to the road itself. So southern Yunnan may contain many species still to be discovered. And while the area remains a delicate one for scientific expeditions, they are likely to remain unknown. As, of course, are Wilson's reasons for topographical, even more than floral, reticence on the journey when he travelled as a parcel.

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Notes:

1. Director, Royal Botanic Gardens, Kew.
2. *Kew Bulletin* 1907, p. 302.
3. *Journ. Roy. Hort. Soc.* vol. 28, p. 57.
4. E. H. Wilson: Aristocrats of the Garden, Williams and Norgate Edition, London, 1938, p. 284.
5. James H. Veitch: *Hortus Veitchii*, London 1906, p. 93.
6. *Journ. Roy. Hort. Soc.* vol. 28, lii.
7. 1903, no. 848, p. 197, fig. 83.
8. t. 7981 (1904).
9. Wilson: *op. cit.*, p. 284.
10. *Kew Bulletin* 1898, p. 289.
11. *Kew Bulletin* 1897, p. 100.

As indicated, one of Wilson's principal objects on his first trip was to secure seed of Davidia. In May 1900 he found "a considerable grove" of trees. From this grove in November of the same year he collected "a quantity of fruit which produced some thirteen thousand plants." Wilson collected more seed in 1903 and 1904.

Contrary to the original speculation concerning the rarity of Davidia in the wild, Wilson commented as follows: "This remarkable tree is fairly common in moist woods throughout western Szechuan between altitudes of 1600 and 2500 m. . . . The tree grows to the height of 20m (± 60 ft.) with a girth of trunk of 2m (± 6 ft.); the branches are ascending-spreading and the tree is of a loose pyramidal habit similar to that of the common wild Pear. On old trees the lower branches are wide-spreading. The bark is dark gray, rough, with corky lenticels and exfoliates in thin, small flat irregularly oblong flakes. The wood is white, tough and heavy. . . . When in full flower the tree is more conspicuous on dull days and in the early morning and evening than when the sun is shining. . . ." E. H. Wilson in Sargent, C. S. — *Plantae Wilsonianae.*

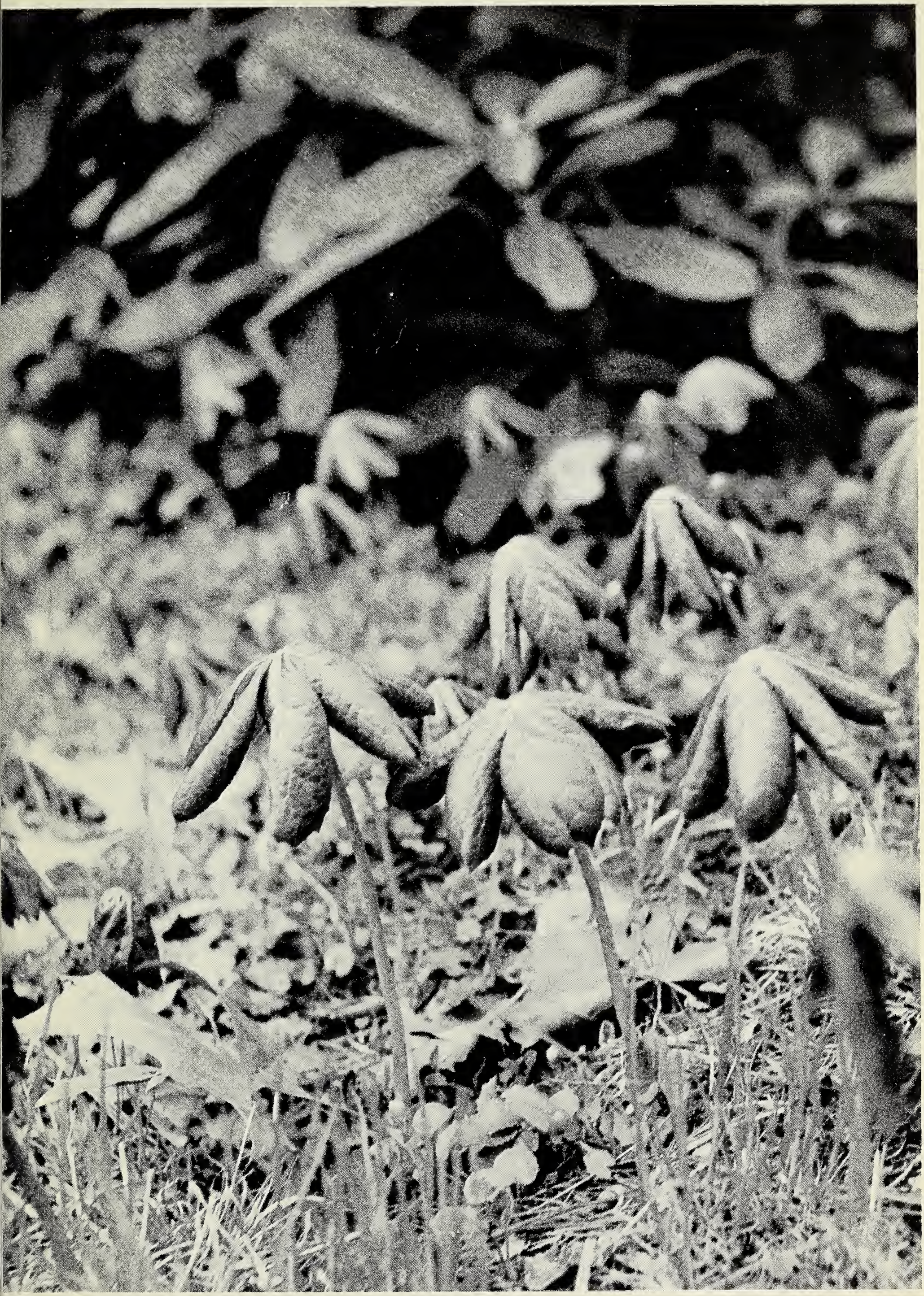
G. P. DeW.

The editor of Arnoldia *has chosen photographs from Wilson's later trips to China to illustrate this article, showing the kind of terrain and the conditions of travel that would have been seen and experienced by young Wilson on the trip described here.*

Errata

On page 82 of the March, 1972, Arnoldia the illustrations above Fig. 48 Alder and Fig. 50 Witch Hazel were incorrectly transposed.

Right: Podophyllum peltatum (*May Apple*) *at the Case Estates in Weston. Photo P. Bruns.*



Gardening Books for Libraries

From time to time we receive requests to recommend books on various aspects of gardening and horticulture. As a result of these inquiries various lists of titles have been compiled. One, a list of reference books of wide usefulness, has already been published.* The present collection is a list of titles suitable for the collection of a public library.

As with any list of titles, the selection is somewhat arbitrary upon the discrimination of the compiler(s). The present selection is based upon an unpublished list compiled by Dr. Donald Wyman some years ago, which has been used as a source of information at the Arboretum. This list has been extensively revised with new titles and categories added.

All that can be said for the present selection is that it is the compilers' belief that the titles are adequate for use by the layman. That is, they survey the particular field and they are reasonably accurate. There may well be titles not listed that are better — it is certain that there are titles in most categories which are totally unacceptable for library use.

There are somewhere in the neighborhood of 200 books published each year in the field of horticulture, broadly construed. A very few of these titles may have unique or lasting value, or may replace older standard works or may be acceptable rehashes of material previously presented or available elsewhere. Many of the volumes, however, are superfluous, trash, or both.

Attention should also be called to several other lists which have been published, which are of importance to librarians and gardeners:

Bowles, E. A. — *Books for a Gardener's Library.* Journal of the Royal Horticultural Society 63(2): 68–73: 1938.

Lawrence, G. H. M. — *An Annotated Guide to Reference Works for Advanced Plantsmen.* Pittsburgh: Hunt Botanical Library: 1966, 19 pages mimeographed.

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* *Basic Books for the Library, Arnoldia* 30(3): 107–113: 1970.

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Right: A visitor enjoying the Lilac Collection.
Photo P. Bruns

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GORDON P. DEWOLF

One Hundred Years of Apples

The Northeastern Section of the American Society for Horticultural Science met in January of 1972 at the Arnold Arboretum for a symposium entitled "A Century of Horticultural Progress." The following article is an excerpt from one of the talks presented. Future issues of Arnoldia will present additional excerpts of talks from these meetings. Ed.

One hundred years ago, the apple industry of this country consisted of seedling trees and named varieties selected from seedlings and propagated vegetatively. The original seeds and plants of a few named selections had been brought from Europe by early settlers.*

Beach's *Apples of New York* published in 1905 described 698 varieties. The origin of 517 are listed as unknown, while the remaining 81 varieties were said to have resulted from seed planted without knowledge of either parent. According to one authority, by 1912 more than 3000 varieties had been described. A few of these developed from seeds supplied by one known and one unknown parent variety. The large majority were chance seedlings with both parents unknown.

The Breeding Program

Prior to 1878 there was no systematic breeding work aimed at improving apple varieties. Between 1878 and 1925 apple breeding programs were initiated at eleven state experiment stations and by the U.S. Department of Agriculture. By 1937 these breeding projects had over 100,000 apple crosses under tests, and the number has increased during the past 35 years.

Today approximately 15 varieties account for 90% or more of the total apples produced in this country. All except Cortland originated as chance seedlings. Cortland is the only variety of any significant commercial importance that has resulted from the breeding program, and its production is limited to the Northeast region where it amounts to less than 10% of the total crop. There are, of course, numerous new varieties that have emerged from apple breeding projects that are being tested by the industry. But none have as yet become commercially important.

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* See "Colonial Gardens" *Arnoldia* Vol. 31, No. 4, July, 1971.

One of the reasons for this is that it takes 40 to 50 years from planting the seed of a new apple for the industry to accept or reject the new variety. Another problem is the fact that all apple varieties are a result of many mixed ancestors, also they are self sterile which means one generally cannot fertilize a flower with its own pollen to keep the strain intact. In the past promising seedlings were often found by chance in open fields and hedgerows but this is no longer true. Therefore long-time breeding programs must continue if further improvement of apple varieties is to be realized, and certainly further improvement is possible and is needed.

Changes in Production

Prior to 1940 research aimed at improving production of apples was, in the main, limited to variety selection and trials, cultural practices including fertilizer testing, pruning, and pollination requirements. Yields ranged from 200 to 400 bushels per acre depending on variety, soil and management. The annual crops alternated significantly, resulting in a light crop one year followed by a heavy crop the next year. During the past 30 years more changes have occurred in the apple industry in eastern and mid-western areas of the United States than in all of its previous history. These changes were the result of modern technology and can be seen in a study made in New York State. In 1939 there were slightly over 5 million apple trees in the state of New York, yielding 19 million bushels of apples. In 1966 there were close to 2 1/2 million trees giving 22 1/2 million bushels of apples.

Several diseases and insects attack the apple. In humid areas, such as the Northeast section of the United States, apple scab (*Venturia inaequalis*) affects both foliage and fruit. Sprays for control of this disease are essential for the production of acceptable fruit. Apple growers began to use Bordeaux sprays for scab control about 1890 and continued this practice until 1910. These copper sprays caused russet on fruits. Following the work published by the Cornell University Agricultural Experiment Station in 1909–10, lime-sulphur sprays replaced the copper compounds. Sprays of elemental sulphur were initiated in the mid-1920's and increased in use during the 1930's. These sulphur sprays, both lime sulphur and elemental sulphur for scab control, were standard practice for the 40-year period 1910–1950.

In the early 1930's, it was shown that sulphur sprays, when employed as a fungicide reduced the process of photosynthesis by apple foliage in amounts ranging from 30 to 50 per cent depending on material and conditions at the time of application. Comparing elemental sulphur and lime sulphur as a seasonal fungicide program on mature McIntosh trees for a 5-year period, an increased yield of 225 bushels per acre was found in favor of the elemental sulphur. In a similar field experiment on mature McIntosh trees where Fermate was compared with elemental sulphur, there was an increase in yield of 200 bushels per acre in favor of Fermate. Thus increased yields of the McIntosh variety amounting to over 400 bushels per acre were obtained by the development of nontoxic organic fungicides. Similar results have been reported by other investigators throughout the eastern apple districts of the United States. These field experiments were excellent confirmation of the earlier work on effects of sulphur sprays on photosynthesis.

While emphasis on confining plantings to the better varietal selections, improved nutrition, the correction of soil acidity resulting from 40 years of sulphur sprays, and the limiting of plantings to the best soils and sites have been contributing factors, the development of non-toxic fungicides and insecticides was certainly the most important contribution to obtaining significantly better yields of fruit.

Harvest Drop

As apples mature, the fruits of some varieties may absciss and drop. The harvest drop problem varies with the variety. McIntosh is notorious for this fault and if warm weather prevails during the latter part of the harvest fifty per cent or more of the crop may fall from trees before they can be harvested. In 1939 it was learned that a spray containing naphthaleneacetic acid at concentrations of 10 to 20 parts per million would delay abscission and control harvest drop. Later work showed other growth regulating chemicals were effective for this purpose when used as preharvest sprays. Adaptability of these chemicals vary with the variety. The grower has considerable choice and is now in a position to control fruit drop of his apple crop until the harvest is completed.

Changes in Cropping Habit

When left to its natural fruiting habit the apple is characteristically biennial; i.e. a heavy crop is followed by a light crop.

This phenomenon has been recognized since the beginning of apple culture. There is now good evidence that the seeds in developing apple fruits are the guilty organ which have some unexplained physiological effect in inhibiting flower bud formation. When there are too many fruits with too many seeds, the newly formed spur buds remain vegetative and there is little bloom the following year.

Biennial bearing creates marketing problems. There is a year to year irregular supply to the consumer. The grower is plagued with too many small fruits in the heavy crop year and too few fruits in the light crop year. While growing costs up to harvest time are approximately the same in the heavy crop year as in the light crop year, fruit prices are low when the crop is excessive and high when the crop is light. Biennial bearing is uneconomic.

Thinning or removal of excessive fruits is the only practical means of assuring annual bloom and annual cropping. The thinning must be accomplished within 3 to 4 weeks of bloom or else many buds will have passed that stage in which they can be influenced to form flowers. Even if labor were available, hand thinning of commmercial apple plantings sufficiently early to assure annual flowering would be impractical.

Research on the possibility of spray-thinning apples was started in 1940. The early work involved bloom sprays (of dinitro-ortho-cresol) which prevented fruit set by unpollinated flowers. During the 1940's and 1950's it was learned that the growth regulating chemicals (naphthaleneacetic acid and its amide, naphthaleneacetamide) would reduce fruit set when applied during the post bloom period. In 1959 Sevin (l-naphthyl N-methyl carbamate) was found to be effective in thinning apples when used as a post bloom spray.

Early results varied from overthinning to no thinning. With continued effort a better understanding of those factors which influence results was obtained and the extremes in amount of reduction in fruit set have been brought closer together so that present day results may average within ten per cent of the amount desired.

During the 20-year period, 1935–1955, the light year apple crop in New York State averaged 14 million bushels while production in the heavy crop years reached 22 to 23 million bushels. The average extent of alternation for this 20-year period was 35 per cent. Spray thinning of apples became a widely used practice during the late 1950's and early 1960's. With commercial use of the practice annual cropping during the

1960's has ranged between 22 and 24 million bushels. This is a better situation for both the apple industry and the consumer.

The Golden Delicious apple originated as a chance seedling in West Virginia. It was named and introduced in 1914. From the few early plantings it was soon learned that Golden Delicious set heavy crops, required much hand thinning and was completely biennial. There was little interest in the variety until the mid-1950's when growers recognized that spray thinning would solve the problem. Then planting of Golden Delicious increased rapidly. In 1969 production of Golden Delicious exceeded McIntosh production and today Golden Delicious is the second most important variety grown in the United States. Thus, technology made an important commercial variety from a chance seedling that otherwise would have been discarded.

Developments in Storage

Apples must be held in some type of storage, if there is to be a supply of fresh fruit during the winter. The fruit cellar, with its dirt floor, served this purpose in rural America during the early years and explains why certain varieties possessing good keeping quality, such as Roxbury Russet, a Golden Russet, were popular in those days.

As the urban market developed, the common storage came into use to supply this outlet and lay the foundation for a commercial apple industry. The common storage was an insulated structure which was cooled during fall months by introducing cool air at night through suitable ports. All openings were closed during the day. The cool air introduced at night was circulated by gravity or forced through the storage by fans. Cooling of the common storage with night air was sometimes supplemented by the use of ice. This type of storage was used for many years. Bulletins published as late as the mid-1930's describe the best designs and techniques for operating the common storage. The main disadvantage of the common storage was the slow removal of field heat from fruit. This was a serious problem during harvest seasons characterized by warm weather.

To overcome the faults of common storage, interest in refrigerated storage was initiated during the first decade of this century. The first ones consisted of refrigerated warehouses centrally located in fruit areas or large cities. As rural electrification developed and refrigeration equipment improved during the 1930's, refrigerated storages began to appear on individual fruit farms. By 1950 there were several hundred refrigerated farm storages throughout the fruit areas of New England and New York.

Apples can be held satisfactorily for rather long periods in refrigerated storage. The length of the storage period in this type of storage depends on the variety and other factors. For example, when McIntosh are stored later than January in refrigerated storage with normal atmospheres, the fruits are susceptible to a storage disorder known as brown core. Because of the importance of McIntosh in the New England and New York areas, research on Controlled Atmosphere (CA) storage was initiated in 1937. This type of storage was based on the established principle that if the amount of products involved in a given reaction can be controlled (in this case, the involvement of oxygen and carbon dioxide in respiration), the rate of the reaction may be controlled. The original experiments on McIntosh in CA storage more than doubled the period over which this variety could be satisfactorily held in refrigerated storage with normal atmospheres. The first commercial CA storage room for apples in this country was constructed by a New York State apple grower in 1940. It had a capacity of 10 thousand bushels. Thirty-one years later, 18.0 million bushels of the 1971 U.S. apple crop was placed in CA storage. The Northeast area, including New England, New York and New Jersey account for approximately one-third or 6.2 million bushels of the present CA storage space. By varying slightly the per cent of oxygen and per cent of carbon dioxide for different varieties, the CA environment has proven well-adapted to most varieties. Thus CA storage as a supplement to refrigerated storage with normal atmosphere, has extended the marketing season for fresh apples throughout the late winter, spring and early summer months or until early varieties of the following year's crops begin to mature. The present day consumer is never without the opportunity to obtain fresh apples.

During the storage period, the greatest losses to the apple industry have been due to a physiological disorder known as scald. This nonparasitic storage trouble causes the skin to turn brown and the fruit is unsalable in fresh fruit channels. In its late stages scald affects the fruit so deeply it cannot be properly peeled for processing. Four decades of research have given no satisfactory explanation of the basic causes of scald. Susceptibility of apples varies from season to season. While climate during the growing season seems to play a part in susceptibility of stored fruit, all factors responsible for a "bad scald year" have not as yet been defined.

Prior to 1955 the only means of scald control in significant amounts was the wrapping of individual fruits in paper treated with white mineral oil, or by mixing shredded oiled paper with packed fruit. This method calls for grading, wrapping and packing prior to storage, rather than on removal of fruit from storage when grading and packing for market can be more appropriately done. In 1956 it was reported that DPA (diphenylamine) showed promise as a chemical treatment for scald control. Further research efforts on this approach indicated another chemical, Ethoxyquin (6-ethoxy-1,2, dihydro-2,2,4-trimethyl quinoline) had similar effects. Developmental work with these two chemicals has shown that dipping the fruit is the most effective means of scald control with either DPA or Ethoxyquin. Dipping assures complete fruit coverage. Concentrations of 1,000 to 2,000 ppm. of DPA or 1,800 to 2,700 ppm. of Ethoxyquin, depending on variety, are appropriate.

Other methods of treatment such as spraying the fruit on trees just prior to harvest or spraying it after harvest in field containers or as it passes over grading machinery has given significant control of scald. But these methods are not as effective as dipping for complete coverage.

Because of susceptibility to scald in CA storage, the Cortland apple could not be held in this type of storage prior to the discovery of chemical control for scald. This development has been responsible for maintaining Cortland at its present level on the commercial list.

The apple industry now has a simple chemical method for scald control, which when properly used will avoid the heavy losses of previous years. At present, approximately 15 million bushels of apples are treated annually for scald control.

As in the production of apples, the past 30 years has brought tremendous improvements in the storage and length of marketing season of this important fruit. While costs experienced by the apple industry have risen significantly in recent years, the wholesale price has increased little, if any. Technology has made this possible.

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The ‘Rochester’ Strain of Lilacs

Modern lilac breeding was begun a century ago during the Franco-Prussian War, by Victor Lemoine, a nurseryman of Nancy, France, as a diversion from the trials of the time. With the able assistance of his wife, Lemoine dusted pollen of what were at that time the handsomest single lilacs, ‘Ville de Troyes,’ ‘Sanguinea,’ and others, onto the almost inaccessible stigma of ‘Azurea Plena’ to produce a race of ornamental double lilacs, the so-called French hybrids.

Single lilacs have only one tubular corolla (circle of petals), having four lobes. The individual flowers (florets) of double lilacs have two corollas, one inside the other, forming a rosette of petals.

Some of Lemoine’s superb new lilacs were ‘Lemoinei’ (1879), ‘Alphonse Lavalle’ (1885), ‘President Grevy’ (1886), ‘Mme. Lemoine’ (1890), ‘Belle de Nancy’ (1891), and ‘Charles Joly’ (1896).

Lemoine’s son, Emile, in time relieved his mother as technical assistant. He reversed her technique by applying pollen of the double flowered lilacs on to the stigma of single flowered lilacs, an even more difficult task since it required removing the pollen-bearing anthers from the flowers to avoid the possibility of self-fertilization. As seed parent (female parent) Emile used the single white ‘Marie Legraye.’ Most of the finest white double lilacs produced up to fifty years ago came from this parent, one such being ‘Edith Cavell’ (1916).

The ‘Rochester’ lilac is a seedling of ‘Edith Cavell’. It was raised at Highland Park, Rochester, New York, by Richard A. Fenicchia, Superintendent of Horticulture. The seedling plant was slow to develop, but its dwarfness and glistening white flowers attracted attention. This cultivar is slow to propagate and therefore is not likely to become popular.

However, ‘Rochester’ possesses two noteworthy characteristics: the florets are often five lobed or petaled (in freaks sometimes seventeen develop) and the color is of good substance, that is, slow to fade. In particularly fine plants the petals are

incurved or boat-shaped, giving a two-toned or bicolor effect, while with certain plants the petals are even streaked or striated in a deeper shade of the basic color. The colors range (according to the Nickerson Color Fan) (3) from light violet through strong purple to deep reddish-purple, the whole spectrum of the common or French hybrid lilacs.

'Rochester' is itself a seed parent; its progeny becomes known as the 'Rochester' strain. The following novelties are noteworthy. 'Dwight D. Eisenhower' R-102 is a light violet (all color names are those of the Nickerson Color Fan) which popularly passes for a pale but intense blue. The pollen parent is 'Mme. Charles Souchet.' Another seedling of the same cross is 'John Dunbar' R-101 with brilliant violet flowers in a conical thyrse six inches tall.

The following pair resulted from the cross with 'Edward J. Gardner': Dr. Edward Moore R-88 is a light violet with florets loosely disposed in a seven-inch thyrse, 'Frederich Douglass' R-74 has bicolored florets of strong reddish-purple in multiple thyrses six inches tall. The following trio are open-pollinated seedlings: 'Bishop McQuaid' R-63 has bicolored florets of strong purple in nine inch candle-like thyrses; 'George Ellwanger' R-46 bears streaked florets of moderate purple on nine-inch thyrses; while 'Barney Slavin' R-18 has glistening white florets in eight-inch thyrses.

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Left: Syringa vulgaris *'Rochester.'*
Photo Monroe County Parks, Rochester, N.Y.

Weeds: A Link With the Past

Bouncing Bet

Bouncing Bet, or Soapwort (*Saponaria officinalis*), is a member of the Pink family (*Caryophyllaceae*) which often brightens railroad embankments and empty lots with masses of pale pink, raspberry scented flowers. Dioscorides called it "Strouthion" and wrote of its use as a soap "which Fullers use for making cleane their wools." The fulling of newly woven wool cloth entailed washing the cloth with a soapy substance to clean it and to shrink the fibers so it would mat and become more dense and compact.

The roots of Bouncing Bet were gathered when the plant was in flower, and soaked in water to extract the mucilaginous saponin. This mixture produced a soapy lather and gave the plant one of its names, 'Fuller's Herb." It was also useful for washing silks, as it not only cleanses, but when dry leaves a luster on the cloth. In fact it is still used in parts of Europe for cleaning old tapestries.

John Parkinson wrote in the 16th century "wild sopewort is used in many places, to scour country women's treen [wooden] and pewter vessels." The leaves were sometimes used as a poultice for small cuts and abrasions, and earlier Dioscorides spoke of it as a remedy for those who were "liver-sick."

The plant was naturalized in England in the 16th century, and its double-flowered variety was popular in early English gardens. Its weedy tendencies were recognized, however, as John Gerard wrote, "If they have but once taken good and sure rooting in any ground, it is impossible to destroy them." Gerard, who lived in the 16th century, was an herbalist and surgeon, and during a large part of his life he maintained a garden for the growing of medicinal plants, or simples. He produced an "Herball" which, although in some respects a translation and rearrangement of other earlier writers, did include some of his own observations on medicinal plants, and was the first popular book on gardening adapted for English gardens.

Today Bouncing Bet, or *Saponaria*, has several horticultural varieties ranging in color from white to reddish purple, but its Latin name, from *sapo*, meaning soap, continues to remind us of its usefulness in the past.

HELEN ROCA-GARCIA

HRG

Arnoldia Reviews

Outdoor Laboratory. People and Their Environment. Teachers' Curriculum Guide to Conservation. Edited by Matthew J. Brennan. Chicago: J. G. Ferguson Publishing Co. 1969. 142 pages, illustrated.

Outdoor Laboratory is one of eight curriculum guides in the series *People and their Environment*, a broad program for teaching conservation in grades 1–12. This volume focuses on the obvious, and therefore overlooked, idea of using the outdoors to teach about the natural environment. "Why study erosion by pouring water over a box of soil in a messy artificial classroom demonstration when a bit of the schoolyard (even an asphalt one) washes down the gutter every time it rains," it asks?

I know from my own teaching experience that a curriculum guide can be a prescription for drudgery or a suggestion box of good ideas. So much depends on the selectivity of the teacher who is using it. For instance, I would have difficulty with Lesson 17 (Forests — Awareness of Beauty). Standing in a forest with a group of six to twelve year olds and asking them "How do you feel as you stand quietly here?" is not my cup of tea. Nor could I assign the suggested essay on the travels of a paper plate at a picnic. That is not to say however, that there are not teachers who could make Lesson 17 a rewarding experience. More to my taste is Lesson 19 which teaches the value of insects (I had a sixth grade teacher who let us dig earthworms for her daily fishing trip) or Lesson 20 on Birds (I didn't know that Ptarmigans have feathered feet for walking on snow — an adaptation to their environment).

The only quarrel that I have with the guide — and it would be resolved by my selectivity — is that the trail to nature in Unit 1 passes through "First Aid in the Outdoors" and "Water safety in the Outdoors" in Lessons 1 and 2. After reading about shock, heat exhaustion, heart attacks, black widow spider bites, and accidental drowning (as different from suicide, I suppose), I wouldn't set foot out of the classroom.

D. M. V.

The Time-Life Encyclopedia of Gardening — Bulbs. James Underwood Crockett and the Editors of Time-Life Books. Boston: Little, Brown and Company. 1972. 160 pages, illustrated. $6.95.

This is a coffee table book with instructions for growing. The most useful feature of the book is the series of water color paintings of about 150 kinds of bulbs. These alone are worth the price of the book. The text is informal and informative, the historical notes are accompanied by some very interesting reproductions of paintings, which unfortunately are very sketchily identified. All in all, good value for money.

G. P. DeW.

Proven Herbal Remedies. John H. Tobe. St. Catharines, Ontario, Canada: The Author. 1969. 304 pages. $8.95.

People are always looking for an easy solution to their problems. For some, it is easier, or pleasanter, to believe what they want to believe than to rely upon facts, which they tend to find unpleasant. Over the centuries many plant products have been touted as "cures" for diseases. Most of them are harmless, a few are dangerous. The present work is a compilation of "folk" remedies, based in part on John Parkinson's *Paradisi* . . . of 1629 and Thomas Green's *Herbal* of 1820. It is rather frightening to see Water Hemlock and Peyote, for example, listed as home remedies. It is unfortunate that the official pharmacopoeias of the 18th Century were not consulted!

G. P. DeW.

Florida Gardening Month by Month. Nixon Smiley. (Revised Edition) Coral Gables, Florida: University of Miami Press. 1970. 189 pages, illustrated. $5.95.

This is directed to the newcomer to gardening in South Florida. It is written in a chatty, informal style, and conveys a surprisingly large amount of practical information.

Recommended for northern gardeners who plan to spend the winter in South Florida.

G. P. DeW.

Next page: Viburnum *in the Arnold Arboretum.*
Inside back cover: Edge of pond, early spring.
Photos P. Bruns.

ARNOLDIA *is a publication of the Arnold Arboretum of Harvard University, Jamaica Plain, Massachusetts, U.S.A.*

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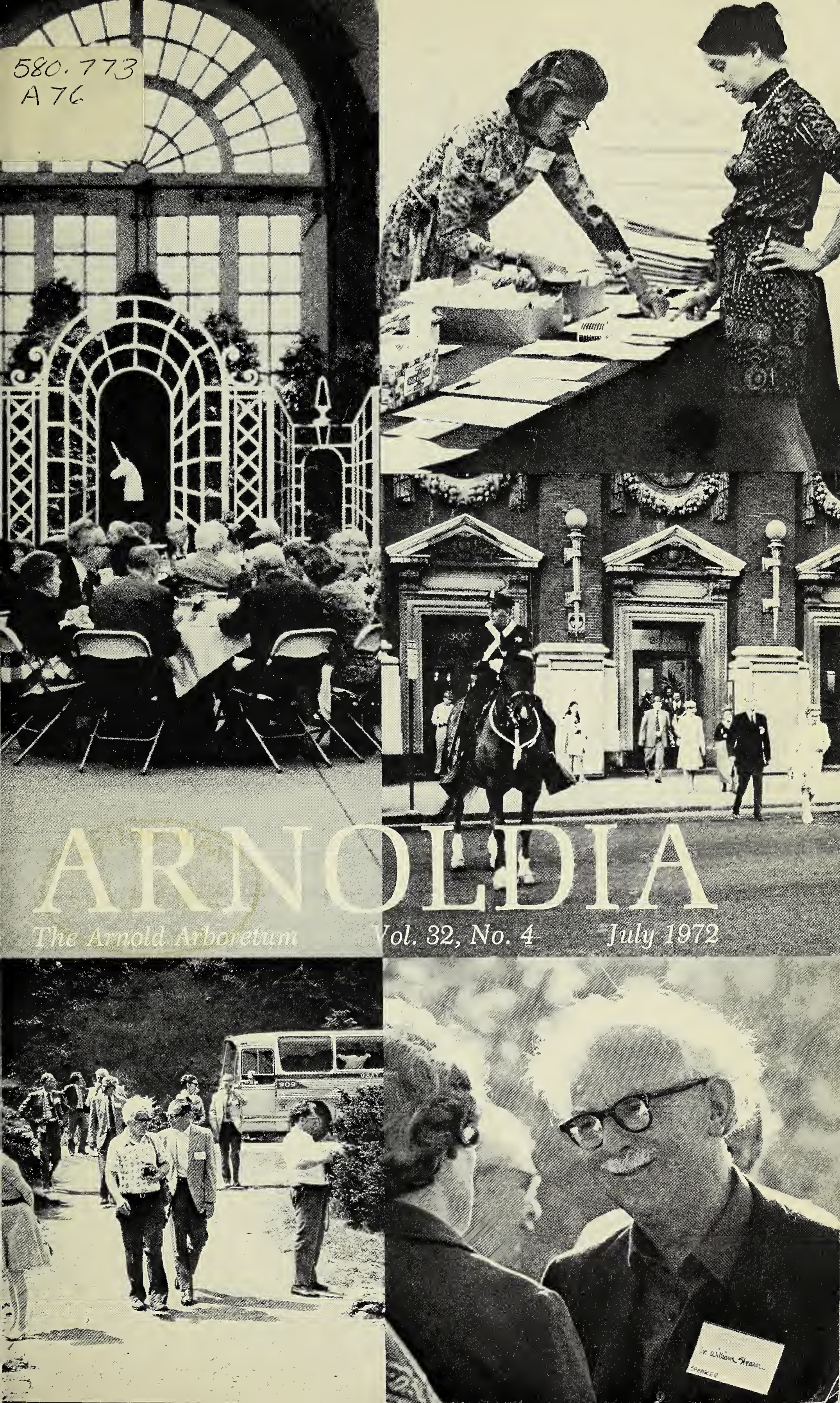

ARNOLDIA

The Arnold Arboretum *Vol. 32, No. 4* *July 1972*

Contents

141 The Making of a Botanist
GERHARD REHDER

157 Centennial Views

160 A Simple Frame for Softwood Propagation
ALFRED J. FORDHAM

165 News from the Arboretum

166 Arnoldia in the Kitchen
HELEN ROCA-GARCIA

168 Arnoldia Reviews

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The Making of a Botanist

The centennial celebration of the Arnold Arboretum pays deserved tribute to the men who fashioned the "worn-out farm" [1] into one of the world's greatest parks and botanical institutions. There is an interesting parallel here with a park in East Germany, the park in Muskau, Upper Lusatia, which too was fashioned from seemingly unpromising material into one of the outstanding parks of Germany and western Europe by the devotion and energies of a few men.

A close personal tie exists as well. Alfred Rehder, who served the Arboretum for fifty-one years, next only to Sargent in length of service, was the grandson of one of the men who laid the foundations of the greatness of the park in Muskau.

This personal tie, and the obvious likelihood that Alfred Rehder's interest and training were influenced by his family background, led the editors of *Arnoldia* to suggest that an article on this subject would be appropriate at this time.

To go back over a century and a half to the story of the founding of the park in Muskau [2] takes us to the spring of 1815. The long wars of the French Revolution and Napoleon were coming to an end, though for the moment, seemingly rekindled by the Emperor's dramatic return from Elba. Seven weeks before Waterloo, on May 1st, Count Hermann Pückler,[3] heir since the death of his father four years earlier to the feudal domain of Muskau, issued a proclamation to the inhabitants of the town announcing his intention to devote himself to the management of his inheritance and to transform a large part of the domain lands into a landscape park on the English model. Thus the first of May 1815 is regarded as the official date of the founding of the park.

Count Hermann, on several visits to England, had come to admire the landscaped parks which were replacing the formal gardens of an earlier era. In deciding to follow this model in his proposed park he was to become one of the leaders in bringing the "natural" landscape style to Germany and would

Muskau Park, East Germany

make his park in Muskau a model which would influence parks throughout central Europe.

The political events of the time, and other duties which engaged Count Hermann, including another visit to England in 1816, did not allow him at once to turn his attention to the carrying out of his plans. Finally in 1817 he was ready to take up residence in Muskau and begin the great task which he had set for himself. It was obvious that he needed a trained gardener to assist him and he found the right man when, in that same year, he brought Jacob Heinrich Rehder to Muskau.

For thirty-five years Rehder was to direct the work which created the park, laying the foundations on which his successors were to build. Count Hermann (after 1822, Prince Hermann) might contribute the drive, the imagination and the financial means, but it would be Jacob Heinrich who would translate the dreams and proposals into reality, devising the methods and supervising the day-to-day work.

Jacob Heinrich Rehder, the grandfather of the Arnold Arboretum's Alfred Rehder, was born February 18, 1790 in Eutin, the chief town in a small enclave of territory belonging to the Duchy of Oldenburg and located near the free Hanseatic city of Lübeck. His ancestors, judging by the name, came from this region along the Baltic Coast. The name Rehder (also spelled Reeder and Reder, but in all cases pronounced alike) is an occupational name denoting a shipper or ship owner, and is not uncommon in this part of Germany. The word, with this meaning, is still current in the German language.

A century earlier Jacob Heinrich's forebears had been farmers in the countryside outside Eutin, a region of lakes and rolling hills somewhat exaggeratedly called the "Holstein Switzerland". The grandfather, Joachim, moved into Eutin, became a burgher (in those days a meaningful title), and took up a trade. His son, Paul Heinrich,[4] followed in his footsteps.

It was Jacob Heinrich,[5] eldest son of Paul Heinrich and his wife Juliane von Decke, who was again to break the pattern. In him the call of the soil seemed to reassert itself. In the spring of 1806, at the age of sixteen, he began a three year apprenticeship in gardening in the park of Ludwigslust,[6] the summer residence of the Dukes (after 1815, Grand Dukes) of Mecklenburg-Schwerin. In 1809 he received his certificate testifying to the successful conclusion of his apprenticeship.[7]

In those days the old guild system still carried on in some vocations, and the period of apprenticeship was followed by a period as "journeyman", when, seeking work where one cared to or could find it, one was paid a daily wage. We do not know for sure where Jacob Heinrich worked in the eight years before he was called to Muskau, but it is likely that he spent part of this time, if not the larger part, on the estates of the Counts Brühl in Pförten, Brandenburg, working under the court gardener, Paul Hermann Schmidt. We do know that in 1821, after he was well-established in Muskau, he returned to Pförten and married Paul Hermann's eighteen year old daughter, Auguste Friederike.[8] His grandson was to follow a very similar pattern. Auguste Friederike outlived her husband by thirty-eight years, dying in Muskau in her eighty-eighth year in 1890. The grandson remembered her well.

In 1817 Count Pückler and his newly-appointed Head Gardener Rehder were ready to begin work on the park. One can gain some idea of the problems faced and contributions made by Jacob Heinrich from the following description written by Jacob Heinrich's successor, Eduard Petzold:

"How carefully the Prince treated his material is made clear by the fact that on two occasions he had landscape gardeners come from England. One was the son of the great Repton, the other, named Vernal, was in Muskau from 1822 to 1823. The former was really more landscape architect than gardener, and, like the latter, was really of little use to the Prince, except insofar as both encouraged him in his plans. In comparison he received far greater advantage from his German head gardener Rehder through his tireless carefulness and the skilled way in which he entered into his plans. Rehder is a man to whom the park owes a great deal.

"Certainly it was not an easy task to give expression to the indefatigable genius of the Prince and to carry out his ambitious plans skillfully and tastefully in an unusually short time and with relatively little manpower and financial means. The problems this task presented were solved by Rehder. In a period of thirty-four years, which he devoted wholly to his chosen work, he was able to create under his skilled direction expansive lawns, richly adorned with flowerbeds of all sorts, fields with the most nutritious grasses, picturesque groves of trees and handsome and impressive plantings, all this where before hardly even a blade of grass grew, where the swampy terrain was impassable, and where some miserable sand hills supporting a few wretched pines offered the only vista to the eye of the beholder. What it means to carry out such tasks can be judged only by someone who has done the like. It could have been no ordinary man who could satisfy the Prince for so many years as the right man to carry out his ideas." [9]

On occasion Jacob Heinrich accompanied the Prince on his travels. In the early 1840's both went to Babelsberg, a castle near Potsdam, to consider plans for redesigning its park. It was the residence assigned to Prince William of Prussia,[10] heir apparent to his childless elder brother, King Frederick William IV. Off and on for some ten years the Prince and, on occasion, Jacob Heinrich, worked on developing the park. As a memento of his part in this work Jacob Heinrich received from Prince William a gold watch, still a prized family possession.

Transforming the swampy and sandy terrain along the Neisse River and the spine of a steep ridge behind the town into the landscape park of his dreams cost Prince Hermann a fortune. In addition he rebuilt the castle and was often on travels in Western Europe, North Africa, and the Near East. One might well ask whether this restless romanticist could ever have succeeded in creating his park without the practical and devoted Jacob Heinrich in charge.

Bankrupt at last, the Prince was forced to sell the domain in 1845, though he did it reluctantly and to the sorrow of his loyal townspeople. The park was sold on April 1st to a Count Nostitz who, the following year, sold it to Prince Frederick of The Netherlands,[11] who was to make it his favorite residence up to the time of his death in 1881. Prince Hermann retired to a smaller estate at Branitz, not far from Muskau, where he set about to create a handsome, if more modest, landscape park.[12] He never again openly visited Muskau, but did once attempt a visit in disguise; on being recognized, he left. He died at Branitz on February 4, 1871.

For Jacob Heinrich the more resounding title of Royal Netherlands' Park and Garden Inspector hardly compensated for the loss of the imaginative genius, and the sense of mutual interest and close cooperation which had grown up between him and Prince Hermann. Over the years the two men, with their common passion and their very different but undoubted talents, had developed a mutual respect for each other which gave their relationship a certain informality if never real intimacy. The class distinction, still carefully preserved in the first half of the 19th century, would never have allowed the latter. Yet in his letters to his wife, written from England in 1826–27, the Prince mentions Jacob Heinrich with casual and friendly familiarity; speaks of taking him to the theatre and of his writing busily in his diary while the Prince pens his letter.[13] Again, in a letter written from Muskau in 1833 to his wife, away on a visit, he speaks of a period of unusual heat and drouth in the spring which threatens to ruin much of their work: "Rehder, who has been counting on a thunderstorm since yesterday, but in vain, has become an atheist and refuses to go to church any longer; I, however, remain pious and humble." [14]

The Prince had hoped to establish a burial site in a secluded spot on the forested ridge behind the town. In a life of the Prince which appeared in 1873 this is mentioned: "He wished to be buried here alone, with his loyal and skillful gardener, Park-Inspector Rehder, who had entered his service in 1814. Often he said to him, 'When people pass by here they will say: "Here lies the Prince and old Rehder.' " [15]

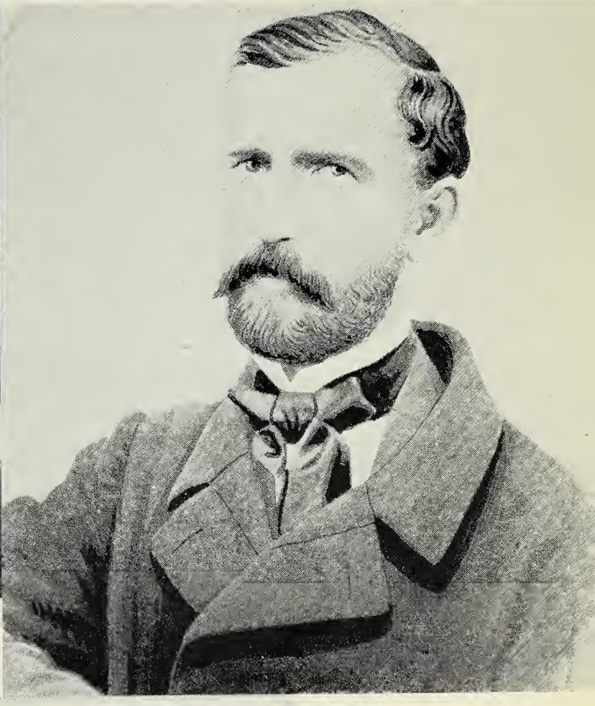
This wish was never fulfilled, but the Prince had the satisfaction of knowing his plans were being carried on by his loyal co-worker who had shared his dream with him. He also was happy in the knowledge that Prince Frederick of The Netherlands had ample means to carry out the development of the park.[16] So the work went on, but the strain of the incessant demands told on Jacob Heinrich's health. He died, rather suddenly, nine days before his sixty-second birthday, on February 9, 1852. He is buried in the old churchyard in Muskau. The town has restored the grave and planted it with roses. In 1965 when the sesquicentennial anniversary of the park was celebrated, a memorial plaque in honor of Jacob Heinrich and his immediate successor, Eduard Petzold (1852–1878), was unveiled. A few days later, in a historical pageant and procession marking the founding of the park, the first carriage contained four townspeople representing Prince Hermann and the Princess and Park-Inspector Rehder and his wife. Just within this past year, a bridge over a stream in the park, in an area known as the Blue Garden, has been named the Rehder Bridge.

Jacob Heinrich left his mark not only in the work he did in developing the park of Muskau, but in the skills and enthusiasm he passed on to three apprentices in particular whom he trained for their gardening careers. Even as he had learned the fundamentals during his apprenticeship in Ludwigslust, so did these three learn under his experienced guidance the fundamentals which would make them outstanding park directors in the following generation. And under two of these men, Alfred Rehder

Right: Jacob Heinrich Rehder

Above: Alfred Rehder

Below: Paul Julius Rehder



of the third generation would receive his training and be launched on a career of distinction that would achieve its fulfillment far from Muskau in an area allied to but differing from park management.

The first of the three, Eduard Petzold,[17] entered his apprenticeship in the spring of 1831, at the age of sixteen, as was then usual. He completed the customary three years and added a fourth, working in the park on a journeyman's wages, and then left to seek work and experience elsewhere. By 1844 he had become court gardener to the Grand Duke of Saxe-Weimar and it was from here that he was recalled to Muskau on the death of his former master in 1852. His careful training by Jacob Heinrich now proved its value for he carried to completion the original ambitious plans and, when he retired in 1878 at the age of sixty-three, the park could be said to have fulfilled with success the dreams of Prince Hermann and Jacob Heinrich Rehder.

But parks are living organisms, and their growth and development are never really finished; here the second notable apprentice was to play the vital role. In the year that Petzold began his apprenticeship, there was born to the local wheelwright, Johann Gottlieb Schrefeld, a son, Gustav.[18] In the spring of 1846, when fifteen and a half, he became an apprentice in the park and, like Petzold, completed his apprenticeship training in three years, staying on for a fourth to work in the park as a journeyman.

In 1850, the fourth year ended, Gustav Schrefeld went to Weimar to work under his fellow-townsman Petzold for a year and a half. Three years of required military service followed, completed in the fall of 1854. He then returned home to Muskau, where Petzold was now park inspector, to work for a few months before being sent to the estate of the Barons Richthofen near Striegau southwest of Breslau, in Silesia,[19] to carry out plans drawn up by Petzold for a landscape park on the estate.

Schrefeld completed the task successfully in three years and in 1858 returned to Muskau. Petzold had established an extensive nursery on the right bank of the Neisse (on what is today Polish territory), and he now put Schrefeld in charge. In the same year an arboretum contiguous to the nursery was begun and with it, a program of systematic collection and cultivation of woody plants. Schrefeld was placed in charge of both nursery and arboretum in 1872. When Petzold retired in 1878, the direction of the park was shared by the newly-appointed

Park Inspector Roth[20] and Nursery and Arboretum Director Schrefeld. Eventually, when Roth left, the direction of the park with its nursery and arboretum were once more unified under Schrefeld.

Following the death of Prince Frederick of the Netherlands in 1881, the estate was sold to Count Hermann von Arnim,[21] member of a wealthy branch of an old Prussian Junker family. Schrefeld continued to carry on the work in the park, expanding in particular the arboretum and introducing many new trees and shrubs. His work was cut short by his untimely death in January 1891.

The third apprentice to receive his initial training under Jacob Heinrich was his youngest son, Paul Julius. He was born January 15, 1833, and began his apprenticeship in the spring of 1849 just as Gustav Schrefeld began his fourth year of training in the park; thus the two became acquainted. Just as Paul Julius was completing his apprenticeship in 1852, his father died. Seven years as journeyman followed during which he rounded out his training.

In 1859 he undertook the direction of the park in Waldenburg, Saxony, then owned by Prince Otto Friedrich of Schönburg-Waldenburg.[22] Two particular tasks awaited him here: to landscape the grounds about the new castle, built on the site of one destroyed on April 5, 1848 by revolutionary peasants and weavers, and to lay out a new park, Grünfeld,[23] on the banks of the river Mulde which flows past the town.

He carried out both tasks successfully and also added to the castle grounds a large temperate house which, with its rare tropical plants, was one of the showplaces of Saxony. This was unfortunately destroyed in 1889 in a severe hail storm and was never rebuilt.

The blow this sudden loss brought may have been a factor in Paul Julius' decision to retire five years later; another, more immediate, was the death in December 1893 of Prince Otto Friedrich, leaving the estate to a sixteen year old grandson.

Apparently, at sixty-one, Paul Julius felt he could not adjust to so great a change. He continued to live twenty-four more years, in honored retirement in his old home, a wing of the castle preserved undestroyed from the pre-1848 period. On December 8, 1917, in the dark final winter of the war, he died a few weeks before his eighty-fifth birthday.

For some thirty-four years he had directed the park and gardens of Waldenburg, the same span of time which his father had spent at Muskau. They were fruitful and satisfying years, even if Waldenburg broke no new paths in park design or in arboriculture and there was never the close bond of interest between park director and park owner which had existed at Muskau.

Paul Julius' home life was a happy one. In 1862, four years after taking up his work in Waldenburg, he had brought home as his bride a young girl, Thekla,[24] daughter of Dr. Med. Johann Julius Schmidt of Hohenleuben.[25] On September 4, 1863, in the wing of the old Schönburg castle which was their home, their first child, a son, was born and christened Alfred. It was he who was destined to link Waldenburg and Muskau and the Arnold Arboretum. Two other sons, one of whom died in infancy, and three daughters followed.[26]

Alfred Rehder [27] grew up in Waldenburg, attending elementary school there until 1874 when he was sent to the neighboring town of Berga on the Elster River, to live with a maternal uncle and be prepared particularly in Latin, French and ancient history for the entrance examinations to a gymnasium.[28] After two years, at the age of twelve and a half, he was enrolled in the "quarta", or eighth grade, of the gymnasium in Zwickau, the nearest such school to Waldenburg. Here he studied for five years, spending his holidays at home or visiting his numerous maternal relatives in Thuringia. In April 1881 he graduated and his formal schooling came to an end.

Usually one would consider graduation from a gymnasium the preliminary step to matriculation in a university; for Alfred this was not to be, for his father was in no position financially to support a son at a university. The son, therefore, returned at once to Waldenburg and, in the same month in which he graduated, entered his apprenticeship under his father's tutelage. If he felt any disappointment he did not show it, but we can judge from subsequent events that he was as determined as ever to find his own career in the field of systematic botany.

This was the decisive moment in his life. Had he gone on to a university and achieved a doctorate he undoubtedly would have remained in Germany, probably at a university or botanical institute, no doubt achieving a degree of distinction, for the talent and devotion to work was there; but he would have been one among a score of distinguished botanical scientists in the established institutions of Western Europe. Now he was faced with a challenge, not like the one which his grandfather had faced of swamps and sandy soil. Equally demanding, it was somehow to acquire the knowledge, to force his way without the talisman of a doctoral degree (in Germany by then already indispensable for recognition and advancement) into the ranks of scientists; to be able to make a real contribution in his chosen field; and to win acknowledgment of his talents from his peers.

Without realizing it he was already following a pattern of thought more natural to America than the Old World; the pattern of the self-made man, though in this case the field would be science rather than business, and the reward would be professional recognition rather than a fortune. In the end the fulfillment would be achieved by going to America where the results of his efforts at self-education would be recognized, and the opportunity to make use of his talents and to develop them further would be given him.

But that lay seventeen years ahead, and completely hidden from the knowledge of the young apprentice. Through those years of what must often have seemed routine and unrewarding labor, he never seems to have lost his sense of dedication to his goal, his enthusiasm for his science, or his ability to derive pleasure from the life he was living. As in his school days, he traveled during the holidays, took walking tours through the Thuringian Forest, and visited Bohemia. In June 1884, he paid his first visit to Muskau, visiting his relatives, including his grandmother, the eighty-two year old widow of Jacob Heinrich, and meeting Park-Inspector Schrefeld for the first time. In his travels, as at home, he always had his eyes open for anything of interest in the plant world around him, and his herbarium continued to grow.

For three years Alfred Rehder worked in Waldenburg as an apprentice. During this time he published his first scientific article, an anonymous article on mushrooms which appeared in three issues of the local paper in August 1883.[29] His botanical knowledge so impressed his former botany master at the gymnasium, Otto Wünsche, that he was hired to read proof for his "Flora von Deutschland" and, later, for a second work.

With his apprenticeship behind him by March 1884, there followed fourteen years of varied positions, each adding to his fund of experience and used to further his ambition to devote his life to botanical study. He spent twenty months in the Botanic Garden in Berlin, which gave him the opportunity to attend lectures at the university. In 1886 he worked for six months in the greenhouses of a large florist firm in Frankfurt am Main, and in the following year went to Muskau to work under Park-Inspector Schrefeld in the nursery for a year. Whether he was aware during that year of a lively twelve year old, the Park-Inspector's second youngest daughter, we do not know; yet twenty years later she would be his wife.

A year in Darmstadt, at the Hessian Grand Ducal Botanic Garden followed, and then six years as head gardener at the Botanic Gardens in Göttingen, the chief university town in Hanover. Here at last Alfred Rehder had a degree of responsibility and this encouraged his ambitions and his independence. He initiated a complete reorganization of the gardens, began to publish more botanical articles, and came into correspondence with a number of Germany's leading botanists. This independent activity apparently irked the Director of the Gardens and in 1895 Rehder left to accept an associate editorship on the staff of Germany's leading horticultural journal, *Möller's Deutsche Gärtner-Zeitung.*

Fourteen years out of the gymnasium and he had come a long way. If progress was slow, and anything but dramatic, it was solid. A large amount of experience and knowledge was stored in the head of this mild-appearing and gentle-mannered man, with his professional pince-nez and somewhat deceptively fierce, curling, black moustache.

The moment for the breakthrough was at hand; the determined will, the years of patient labor, had prepared him for the moment of opportunity.

As so often with dramatic turning points in life, it came with deceptive simplicity. In 1898 Rehder, since he had mastered English, was to be sent by his paper on a six months' trip to the United States to gather material at firsthand for a series of articles. To add to his slender expense account he had also acquired a commission from the Imperial German Government to make a study of viniculture in upstate New York. He set sail in March 1898, heading for Boston.

He chose Boston because he had heard of the Arnold Arboretum and had written Prof. Sargent asking for an opportunity to do some studying there on his own. While engaged in his studies, to eke out his living expenses he was quite willing to do manual labor on the grounds of the Arboretum for a dollar a day. This story has an eye-catching quality that makes it appear in any account of his first years here.[30] It also tells one something about the man. Like any true friend of the plant world, he never felt that working with the soil was demeaning; nor that any task that was essential was not without its own dignity.

While working on his project, Rehder came to know Prof. Sargent; and Sargent, with his uncanny knack for sizing up the men he needed for his staff, approached him with the offer of a permanent position. Suddenly the goal was within his grasp: the opportunity to work in his chosen field, to work in a new and growing institution with a great potential, and to work with a man of vision, ambition, and understanding. It was almost as if he were living his grandfather's experience over again.

Once the decision was made, the next steps followed in order. The first step was to begin the process of becoming an American citizen. Rehder's own experiences had prepared him to be sympathetic to the American way of life, and he was always grateful for the great opportunity offered him in the land of his adoption. But he also never lost his affection for the land of his birth, the background which had given him his start, and whose traditions he had imbibed as he grew up.

In the course of working on the Bradley Bibliography, the first task Sargent set for him, he was able to take the second important step: to establish a family life for himself. On a trip to Europe in 1904 in connection with gathering material for the bibliography, he arranged to meet the late Park-Inspector Schrefeld's daughter, Anneliese,[31] with whom he had been corresponding for some time, and they became engaged. On March 30, 1906 they were married in Dresden and, after a trip to Italy which combined work in Italian libraries for the bibliography and a honeymoon, they returned in the fall of 1906 to Jamaica Plain, and the European chapter was closed.

So the background and training which reached back more than a century from that date, to Ludwigslust, Pförten, and, above all, Muskau, had brought the fruits to the New World and to a young institution which was then in the early years of its second quarter of a century. It was one element, in its own way unique, which helped make the Arnold Arboretum the outstanding institution it has become. For institutions, like individuals, have many ancestors; and they, like people, can gain inspiration and strength as they move forward into the future by looking back and being aware of their roots in the past.

GERHARD REHDER

Notes:

1. Sargent, Charles S., *The First Fifty Years of the Arnold Arboretum*, Journal of the Arnold Arboretum, vol. III, 1922; p. 130.
2. Kurland, K. H. A., ed., *Führer durch die Park- und Kurstadt Bad Muskau*, 3rd ed., rev. + enl., 1969, Leipzig. This guide book gives a full account of the history of the town and the park. The appendix includes a useful chronological chart of events affecting both.
3. Hermann Ludwig Heinrich, 1785–1871, only son of Ludwig, Count Pückler, Privy Councillor to the King of Saxony, and of Clemintine, Countess Callenberg, heiress to the domain of Muskau.
4. 1762–1847.
5. Born 18 February 1790; died 9 February 1852.
6. Schüttauf, Hermann, *Parke und Gärten der DDR*, 1969, Leipzig. This useful and attractive handbook describes the chief parks and gardens of the German Democratic Republic. Ludwigslust is described on p. 77.
7. This very ornate certificate was one of the prized possessions of Alfred Rehder and hung in his study beside his honorary Master's Degree received from Harvard in 1913.
8. Born 10 October 1802; died 2 February 1890.
9. Petzold, Eduard, *Der Park von Muskau*, 1856, Hoyerswerda.
10. Prince William, 1797–1888, succeeded his brother on the throne of Prussia in 1861. In 1871 he was proclaimed the first German Emperor.
11. Prince Frederick, 1797–1881, was the younger son of King Willem I of The Netherlands (reigned 1813–1840), and younger brother of King Willem II (1840–1849). In 1825 he married Princess Louise of Prussia, sister of Prince William mentioned above.
12. Schüttauf, op. cit., p. 24.
13. Pückler-Muskau, Hermann, Fürst von, *Briefe eines Verstorbenen*, 4 vols., 1831, Stuttgart; vol. 3, pp. 198 and 204.
14. Assing, Ludmilla, *Briefwechsel und tagebücher des Füsten von Pückler-Muskau*, 8 vols., 1873–76, Hamburg; vol. 8, p. 179.
15. Assing, Ludmilla, *Fürst von Pückler-Muskau: Eine Biographie*, 1873, Hamburg; pp. 217–218.
16. Prince Frederick had surrendered his claims to the Grand Duchy of Luxemburg to his brother, King Willem II, for a substantial monetary settlement.
17. 1815–1891. Petzold retired to Dresden in 1878.
18. Born 21 October 1831; died 27 January 1891.
19. Now in Polish territory; Striegau is today Strzegom. Breslau is Wroclaw.

Muskau Park, East Germany

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20. No data is available on Park-Director Roth.
21. Count Hermann von Arnim, 1839–1919. The family held the estate until July 1945 when it was confiscated by the provisional government, then under Soviet protection. It is now state property; the castle was destroyed in the fighting at the end of the war.
22. Otto Friedrich, Prince (Fürst) of Schönburg-Waldenburg, 1819–1893, succeeded to the property on the death of his father in 1858. Before Napoleon's reorganization of Germany the Princes were sovereign in their territories. The property was confiscated by the provisional government in 1945. The castle is now a hospital.
23. Schüttauf, op. cit., p. 140.
24. Born 13 August 1839; married 1 August 1862; died 21 September 1897.

25. Johann Julius Schmidt, 1796–1872, Dr. Med., University of Jena. As a boy he assisted his stepfather, also a physician, with the wounded on the battlefield of Leipzig, October 1813, (Battle of Nations); as a student at Jena he took part in the "Wartburg Festival", October 1817, a student defiance of the reactionary regimes of the time; and as an adult he was one of the founders, in 1826, of a local society for historical and archeological research, which still carries on. The museum, in Hohenleuben-Reichenfels, also exists today.
26. The surviving son emigrated to Brazil in the early 1890's and established a branch of the Rehder family there which still flourishes.
27. For a full biographical sketch see: Kobuski, Clarence E., *Alfred Rehder, 1863–1949*, Journal of the Arnold Arboretum, vol. XXXI, 1950; pp. 1–38. This also includes a complete bibliography.
28. A gymnasium approximates an American college preparatory school; it has an eight year course, grades 5 through 12.
29. It later was reprinted in the agricultural supplement to a newspaper in Chemnitz, a city of some size and industrial importance in Saxony; a testimonial to its quality and its timeliness.
30. As he often used to recall, he found substantial board and comfortable lodgings in Jamaica Plain at that time for $3.00 a week.
31. Born 3 August 1875; died 14 July 1967. Alfred and Anneliese Rehder had three children, two sons and a daughter. At present there are also five grandchildren and four great-grandchildren.

(The author is the son of the Arnold Arboretum's noted horticultural taxonomist. For 25 years Gerald Rehder has taught at the Roxbury Latin School where he is Chairman of the History Department.)

Centennial Week at the Arnold Arboretum

Photos: Paul Sansevero, Gibson Kennedy, Kim Takal, P. J. Chvany.

A Simple Frame for Softwood Propagation

At the Arnold Arboretum's Dana Greenhouses the propagation of woody plant cuttings is carried out largely under polyethylene plastic, except during summer when intermittent mist is employed. The structures and system presently in use have reached a high degree of efficiency due to testing of new ideas and adoption of improvements seen elsewhere.

With the advent of polyethylene plastic film, a great deal of the finicky care previously required to root cuttings has become unnecessary. The plastic material is air permeable, yet vaporproof; this permits a high relative humidity to be maintained, and by reducing transpiration prevents the cuttings from wilting.

By modifying and adapting certain components of the Arboretum's carefully controlled system, amateur horticulturists can propagate easily cuttings that previously were considered difficult. The ensuing device is a simply constructed polyethylene propagating chamber which may be placed outdoors and left for weeks on end without attention.

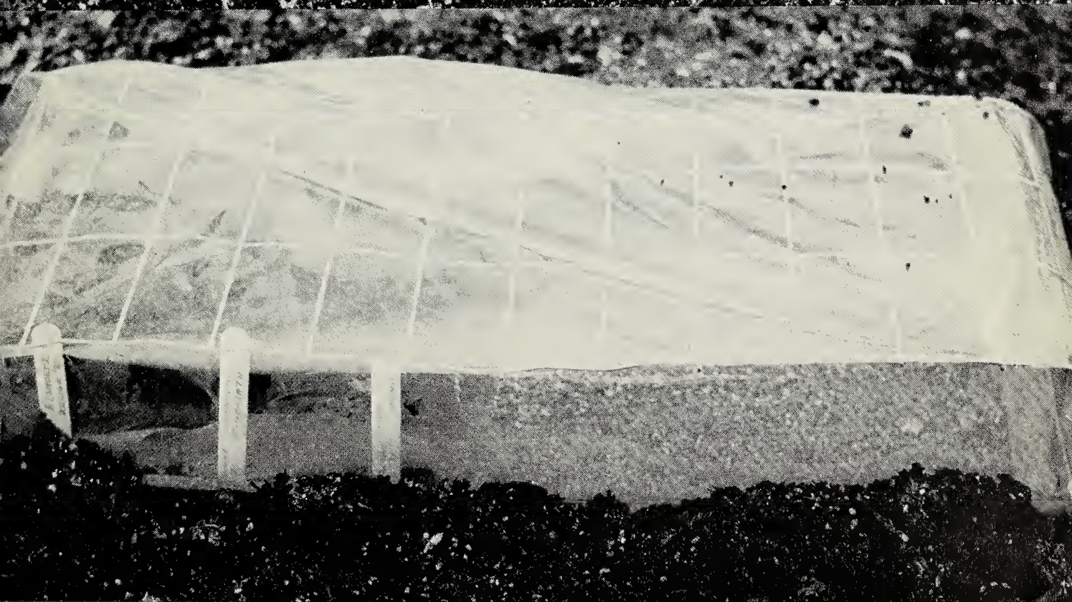
Plate 1 shows an assortment of plants that were rooted from softwood cuttings in such a frame. They include shrubby dogwoods, virburnum, magnolia, buddleia, weigela, and pachistima.

Plates 2 and 3 illustrate the preparation sequence. First, a site is chosen which offers as much light as possible without direct sunlight. (A location on the north side of a house, wall, tree, or such would be satisfactory.) A standard 1 by 2-foot greenhouse flat is pressed against the earth to show its outline, and the soil is then excavated to a depth whereby the flat's edges will be level with the surrounding soil.

Next, two-mil polyethylene plastic is cut to line the flat with enough surplus so that it extends about 2 inches on all sides. The medium (in this instance, half sand and half horticultural grade perlite) is added and slightly firmed.

Plate 2 shows a flat with three rows of cuttings inserted be-

Right: Plate 1 top
Plate 2 middle
Plate 3 bottom



neath a structure of turkey or utility wire which has been cut and bent so that it will support the plastic about 6 inches above the cuttings.

It is important that this framework lie flat at the top, rather than in a curve as is sometimes suggested. Temperatures within the little propagating unit are warmer than the surrounding atmosphere and consequently water continually condenses on the inner surface, then accumulates in droplets which become too heavy to remain. These fall back on the cuttings and into the medium, thus creating an environment of continual moisture. A flat surface above permits even distribution of the falling drops whereas a curved top directs them to the side walls and down, leaving the center portion of the chamber dry.

Collection of Cuttings

It is well to gather softwood cuttings early in the morning for at this time they are in their freshest condition. Only wood of normal growth should be chosen. Immediately on collection, the cuttings are placed in polyethylene bags which are tightly sealed with rubber bands. The bags are not squeezed to exclude air and this permits packing them on top of one another without crushing the contents.

To prevent a buildup of heat within the bag, it must be shielded from the sun. At the Arnold Arboretum we put cuttings into styrofoam or picnic-type coolers and this has proven highly satisfactory. In the event that the cuttings cannot be processed immediately after collection, they will remain fresh for a week or two if stored in a refrigerator at 40 degrees.

Making the Cuttings

The leaves are removed from the part of the cutting which will be below the medium, and a slanting cut is made below the node or nodes (the place on the stem which normally bears a leaf or leaves). If the tip of the cutting is soft and rubbery, it too is removed as it could decompose, thereby inviting fungus infection.

Root Inducing Substances

A number of root inducing substances may be employed. Hormodin #2 or Hormo-Root "B" are used on most softwood cuttings; Hormodin #3 or Hormo-Root "C" would be needed for the more difficult subjects such as Ghent azaleas, stewartias, and so forth.

To prevent contamination, one should work with a small amount of the root inducing material on a piece of paper rather than dip directly into the supply container.

Softwood cuttings are generally moist enough so that it is unnecessary to wet them before applying the auxin. The bases of the cuttings are dipped into the powder just deeply enough to cover the newly-cut surfaces.

Insertion of Cuttings

The cuttings are now inserted in the medium after a hole is made for each large enough to receive it without brushing off the root inducing material. An important point to consider is that cuttings should not be overcrowded. Enough interspace should be left so that air can circulate around the cuttings and light can reach the medium. This sanitary measure aids in preventing problems with diseases. See Plate 4.

Next the cuttings are watered. This serves two purposes: first, it compacts the medium around the cuttings, and secondly, it provides the initial watering.

The framework is put in place and covered with the polyethylene plastic; soil is then mounded over the plastic where it meets the ground. It should be emphasized that with this system of propagation it is imperative that all air leaks be eliminated as they could reduce the very necessary high humidity and cause failure.

After Care of the Propagating Case

After initial watering it is unlikely that any further moisture will be needed. It would be wise, however, to check the cuttings each week or so to make sure that fungus infection is not occurring, or that insects are not present which have hatched from unnoticed egg masses.

Inspections can be made through the transparent polyethylene without its removal. It is unusual for problems to arise through the activity of fungi; however, in the event that this does occur, the covering should be lifted and infected cuttings disposed of. The remainder may then be sprayed with an application of 50% Captan at the rate of 2 teaspoons in a gallon of water.

Tests for Rooting

After several weeks, the cuttings are checked for rooting. This is accomplished by grasping each with thumb and forefinger. A gentle upward tug will show whether the cutting has

Plate 4

rooted. Heavy resistance indicates an extensive root system; slight resistance, either a heavy callous or small roots; no resistance, the absence of roots altogether.

Potting or Boxing

Once the cuttings are sufficiently rooted, they are carefully lifted from the medium and immediately potted or boxed. Material rooted under conditions of high humidity and temperature must be brought into normal atmosphere gradually. This is accomplished by again covering them with polyethylene.

On cloudy, humid days the plastic can be removed; and if several such days occur in succession, the transition will be complete. Otherwise, uncovering the cuttings at night and recovering them during the heat of the day for a period of five or six days will accomplish this very necessary conditioning.

Alfred J. Fordham

News from the Arnold Arboretum

One of the nation's most prestigious horticultural awards, the Medal of Honor of the Garden Club of America, was recently received by Dr. Richard A. Howard. The Arboretum's director was cited for "eminence as a botanist, horticulturist, educator, lecturer, author of definitive monographs on tropical plant material, authority on nomenclature, *princeps* among West Indian botanists."

Howard's award marks the third time an Arnold Arboretum staff member has received the Medal of Honor. Previous recipients were Charles Sprague Sargent in 1920, and Dr. Donald Wyman in 1965.

Also recognized for outstanding work in his field is Alfred J. Fordham who has been given the International Plant Propagators' Society Award of Merit. The honor, presented "in recognition of outstanding contributions to the art and science of plant propagation," is given at irregular intervals; selection criteria include scientific discoveries and application of facts related to propagation practices and techniques.

Shortly before Centennial Week, the Arboretum received an addition to its living collection: a stately Sequoiadendron giganteum, which was bequeathed to it by the late Chandler Hovey of Chestnut Hill. The 40-foot tree attracted considerable attention en route to its new situation in the Kent Field conifer collection. A gift from an anonymous donor paid for the transportation.

Arnoldia in the kitchen

Linden Tea

In Chaucer's day the Linden tree was known as Lynde ("Be ay of chier as light as lyf on Lynde." — The Clerke's Tale). During Shakespeare's time it was known as Line or Lind ("All prisoners in the Line-grove which weather-fends your cell." — The Tempest).

It is only in comparatively recent times that the name Lime tree has come into use, giving rise to the misleading name of Lime Tea for an infusion made from the flowers. Linden flowers were recommended in Gerard's Herball of 1597 as a medicine to be used against colds, dizziness, apoplexie, and "the falling sicknesse". In France dried flowers are still kept in the kitchen for making *tilleul*, and in Spain the infusion is called *tilo* and is used not only as a refreshing drink but also to calm the nerves. On the now-defunct ship, the Queen Elizabeth, Lime Tea appeared as a standard item on the opulent menu.

Lime tea is prepared by drying the fresh flowers. (Care must be taken not to use flowers which have been treated with pesticides.) The flowers are dried slowly in a warm dry room such as an attic. They should be spread out on trays with cheesecloth bottoms, such as the kind that are used for drying mushrooms, or on a layer of paper towels, and when completely dry stored in a tight canister. To prepare the drink boiling water should be poured on the blossoms and they should be allowed to steep.

Dried Linden flowers are also considered beneficial in the bathwater, so whether used internally or externally, these fragrant flowers should not be overlooked by those who are lucky enough to have them in their gardens.

HELEN ROCA-GARCIA

HRG

Arnoldia Reviews

Plants of Hong Kong. Stella L. Thrower. Hong Kong: Longman Group (Far East) Ltd. 1971. 192 pages, illustrated. $4.00 (U.S.) postpaid.

This volume is a handsome addition to the illustrated handbooks of tropical plants and certainly is recommended for any visitor to Hong Kong. It contains one or more colored illustrations, accurately reproduced, of 88 different plants. The illustrations, rarely of whole plants, are mostly moderate close-up pictures of flowering or fruiting branches with some enlargements. The size of the flower is given with each illustration. The plants included range from endemic and native species to exotics and pan-tropical weeds. About one-third of the plants would be found in Hawaii or in the West Indies.

An accompanying text is set in parallel columns in English and Chinese, the latter said to be an exact translation for scientific accuracy. Besides the scientific name, common name, and the plant family there are brief descriptive details, an indication of where the plant can be seen in Hong Kong, and some miscellaneous information; the last, under "points of interest". A glossary of technical terms and a separate list of parts of the flowering plant, each in two languages, explains the vocabulary used and is accompanied by diagrams. The only index is of scientific names and appears on page 1. A few references also are listed.

R. A. H.

North American Apples: Varieties, Rootstocks, Outlook. W. H. Upshall, Editor. East Lansing: Michigan State University Press. 1970. 197 pages, illustrated. $8.50.

A century ago fruit growing was a very important part of domestic horticulture. Today, unfortunately, this is not the case. This book, while written for pomologists, will be of interest to those horticulturists and plantsmen interested in fruits. It is not a book on the culture of apples. The several chapters deal with the major commercial varieties of apples, their history, economic importance, and sports.

G. P. DeW.

New Approaches to Financing Parks and Recreation. Robert M. Artz, Editor. Washington: Acropolis Books. 1971. 126 pages. $5.95.

Financing open space for recreation or education is a problem. This volume does give some information about sources and methods of applying for funds. It would, however, be more appropriate as a pamphlet than as a hard bound book.

G. P. DeW.

Making Gifts from Oddments and Outdoor Materials. Betsey B. Creekmore. New York: Hearthside Press, Inc. 1970. 224 pages, illustrated. $7.95.

At the outset, I want it known that I make things from "oddments" myself, reusing some of the clutter that comes into the house with every trip to the market. Also, I like "outdoor materials" as decorations in my house — dried weeds, seed pods, driftwood, small stones. So, I am not opposed to the idea of making things from "oddments and outdoor materials". I was surprised, therefore, to find that I did not want to make a single item that Mrs. Creekmore describes in her book.

Most of the projects produce "toe covers," to use Betty McDonald's fine phrase — things of little and limited use. For instance, by embedding a dried flower in plastic resin in a glass percolator top, you can make (depending on the size of the percolator top) either a set of drawer pulls, a doorknob, or a decanter stopper. These are all useful items but I do not feel that the labor involved is commensurate with the final product. There is something disproportionate about learning to cure flowers and to cast in plastic resin (both processes fully described in the book) so that you can recycle a percolator top. Of course, it makes more sense if you have on hand the 8–10 tops needed for the set of drawer pulls.

The publishers claim that this book is illustrated "profusely" and "magnificently". Sadly, it is neither. Considering the number of projects which the book details, the illustrations are downright scarce. The chapter devoted to "portable topiary" ("pseudo" and "pseudo-er") contains ten projects and two photographs of finished pieces but not a single illustration of how any of the constructions are to be made. One picture could have been worth several thousand words in this case.

I had to keep reminding myself while I was reading about "arrangements in wallpaper cleaner" and a "glittered pumpkin" that everything in this book is meant to be given away. I do not have among my friends, as the author does, either a "doll collector" who would go ape over the corn shuck doll or "the owner of a country home" who has been breathlessly waiting for that dried arrangement to go on her churn. Perhaps that is the reason for my lack of enthusiasm; if I made any of these gifts, I'd have to keep them myself.

D. M. V.

A Guide to the Wildflowers and Ferns of Kentucky. Mary E. Wharton & Roger W. Barbour. Lexington: The University Press of Kentucky. 1971. 344 pages, illustrated. $9.50.

Since Kentucky does not have a particularly unusual flora, this guide will be of considerable use in many areas of the eastern United States. The plants are illustrated by means of color photographs (a total of 486), accompanied by concise descriptions of distinguishing features, habitat, flowering time, etc. Similar and confusing species are mentioned and often described. Many of the photographs are excellent, but many are blurred, and some are not at all diagnostic. From the photograph, *Valerianella intermedia*, for example, could well be a species of *Polygonum*. Color is poor in the pinks and purples and the whites are often so glaring as to obliterate floral structure. The arrangement of the plates, a thorny problem in guides of this sort, is quite effective. They are broken down into ferns, monocots, and dicots, with subgroups based mostly on floral form and size. Flower color is fortunately not used as a major character. The characters used are well explained and illustrated in most cases, but amateurs will have trouble with some of them, particularly inflorescence type. The systematic list of the families included, with their genera and species, will be useful to amateurs interested in plant classification, and the family descriptions, in non-technical terms, are particularly good.

R. E. W.

Vegetable Dyeing. Alma Lesch. New York: Watson-Guptill Publications. 1970. 146 pages. $7.95.

Natural Dyes and Home Dyeing (formerly titled: **Natural Dyes in the United States).** Rita J. Adrosko. New York: Dover Publications, Inc. 154 pages. Paperback $2.00.

Vegetable Dyeing by Alma Lesch is a very straightforward guide to natural dyestuffs and procedures. There is no deadwood in this handbook; the author begins with general information, continues with 151 dye recipes arranged by color, and concludes with sources of supply and charts for quick reference. It is a "no experience required" kind of book and seems an excellent introduction to the craft.

Natural Dyes and Home Dyeing is a history of dyestuffs in America (see former title) which is posing as a craft handbook. It is a good history, but a poor handbook. The revised "how-to" section is poorly presented and would be difficult for a novice to follow. To her credit, Rita Adrosko includes the botanical names of the dye plants, which to my sorrow, Alma Lesch does not. **Natural Dyes and Dyeing** is a book for the dyeing enthusiast, not the beginner. **Vegetable Dyeing** by Alma Lesch is the one to have if you're having only one.

D. M. V.

Know Your Garden Series: Trees and Shrubs. Richard E. and Charles R. Harrison. Wellington, N.Z.: A. H. and A. W. Reed. 1965. 199 pages. $12.50.

The book is a companion to **Handbook of Trees and Shrubs for the Southern Hemisphere** by the senior author. The bulk of the book consists of about 560 colored illustrations of (generally) flowering twigs of trees and shrubs grown in New Zealand. They are arranged alphabetically by generic name. There are many north temperate zone plants included, along with natives of the Southern hemisphere. A paragraph with each picture gives a brief description and an indication of hardiness. The reduction of each illustration is given, as well as the plant family to which it belongs. Although the color is not always true, and some of the illustrations have suffered loss of detail, this is an excellent guide for identification of many commonly grown woody plants. In this country its greatest use will probably be on the West Coast, but gardeners from Philadelphia southwards will also find it of value.

G. P. DeW.

Plaque presented to the Arnold Arboretum by the International Plant Propagators' Society "in Appreciation for 100 years of Exploration, Testing, Introduction, and Display of Ornamental Plants."

Left to right: Alfred J. Fordham, Charles Hess, Richard A. Howard.

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ARNOLDIA this month is devoted to the Arnold Arboretum Centennial Banquet address, papers presented at the Centennial Lecture Series, and text of the alternate lecture. In January, talks delivered during the Symposium, May 23, will be published.

Contents

173 From Medieval Park to Modern Arboretum: The Arnold Arboretum and Its Historic Background
WILLIAM T. STEARN

198 From Witch Doctor to Modern Medicine
RICHARD EVANS SCHULTES

220 Plants and Gardens of South Africa
H. BRIAN RYCROFT

226 The Population-Environment Crisis — Where Do We Go From Here?
PAUL R. EHRLICH

241 Japanese Bonsai and Bonsai Shows
WALTER H. HODGE

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From Medieval Park to Modern Arboretum:

The Arnold Arboretum and its Historic Background

In celebrating a hundred years of growth of an institution such as the Arnold Arboretum of Harvard University primarily devoted to the cultivation and study of trees, it is natural even if trite to compare such an institution to a tree itself, above all to such an impressive sturdy long-lived tree as an oak, and then to seek analogies of development, elaborating the simile in a manner worthy of an old New England preacher somewhat like Father Mapple of Melville's *Moby Dick.* Thus tree-like, one might say, the Arnold Arboretum thrusts its roots deep into good hard earth such as solid Boston and Cambridge banking accounts provide, pushes out its dollar-fed branches slowly but strongly in many directions to resist wind and tempest, i.e. depressions, slumps, inflations, lawsuits, hurricanes and the like, towers massively above other institutions of more recent sprouting and displays its abundant foliage, both actual and figurative, for all to admire. Such eloquent comparisons can, however, be carried too far. The Arnold Arboretum's publications appreciated by botanists the world over may indeed be likened to the fruit of our imagined tree but, unfortunately for this nice simile, the fruit of an oak is most appreciated by crows and swine!

Nevertheless, the simile has its value. An individual oak, while possessing its own particular characteristics as an individual, grows mainly the way it does because of events which happened even before it started as an acorn, sometimes very long before that. The Arnold Arboretum during its hundred years of growth has certainly been shaped by influences going back some two hundred or more years earlier. Hence, I have thought fit here not to concentrate on this New England institution in its present laudable state but instead to indicate its Old England antecedents by showing how the modern arboretum, so well exemplified by the Arnold Arboretum, has developed from the medieval English deer park, by way of the 18th-century landscaped park, through the interaction of anxiety over timber shortage and of feeling for landscape, which together led to an interest in trees for their aesthetic and scientific value as well as for their economic use. These provide the background to the development of the important features which, thanks to the driving power, the wisdom and the wealth of Charles Sprague Sargent, have come especially to distinguish the Arnold Arboretum.

James Arnold and The Founding of The Arnold Arboretum

A little over a hundred years ago various worthy citizens of Boston and members of Harvard University learned that the trustees of the estate of the late James Arnold, merchant of New Bedford, Massachusetts, had proposed to found an arboretum for Harvard University out of the money bequeathed by him 'for the promotion of Agricultural or Horticultural Improvements'. Arnold, who died in 1863 at the age of 87, was a formidable man of strong physique and domineering character, high intellectual and administrative ability, and shrewd business sagacity. He was noted, according to a contemporary eulogist, the Rev. J. W. Potter, for 'his systematic industry, his indomitable energy and will, his very positive opinions and habit of very positive utterance', and so he became one of 'that successful and high-minded race of men who in the first quarter of the present [i.e. 19th] century were the merchant princes of New Bedford'.

Extensive philanthropic interests, perhaps derived from his Quaker upbringing, tempered his possibly ruthless efficiency. He made his large garden at New Bedford open to all, so that it became a place of public resort and interest, as has the Arnold Arboretum commemorating him, and this garden was celebrated enough in 1844 for the landscape gardener, A. J. Downing, to request a sketch of it. Arnold tragically lost his wife, daughter and sister in quick succession and, having devoted the last 25 years of his long life mostly to charitable activities, he bequeathed his money for their continuation. The foundation of a public arboretum was among his intentions, according to his trustee, George B. Emerson, although not explicitly mentioned in his will. Apparently Arnold had made much of his vast fortune out of the destruction of the timberland of Michigan. By a twist of circumstances, his name for a century now has been associated with an institution concerned for the preservation of trees.

Emerson and his fellow-trustee, John James Dixwell, were certainly much interested in trees, the one as a botanist, the other as a planter; and if, as we must assume, Arnold really wished to found an arboretum, he chose his trustees wisely. The Harvard professor, Asa Gray, had also advocated the provision of an arboretum 'if every means for its support were to be had'. Eventually, in March 1872, the trustees agreed to transfer to Harvard University the Arnold fund for 'the establishment and support of an Arboretum to be called the *Arnold Arboretum*'. Fifty years later, in 1922, the man who converted their good intentions into solid achievement, Charles Sprague Sargent, wrote in the Arboretum's *Journal* that 'the prospect of being able to establish a useful institution would not have been encouraging, if the men interested in it had had at that time as much knowledge as hope and enthusiasm. For it is safe to say that not one of them had an idea of what an Arboretum might be, or what it was going to cost in time and money to carry out the provisions of the indenture'. Sargent as director had to learn all that the hard way.

The word 'Arboretum' was then probably an unfamiliar one in New England. To Boston businessmen it may even have sounded like an exotic disease. However, Webster's *Dictionary* of 1865 would have re-assured them by its entry: '**Ar′bo-re′-tum.** A place in a park, nursery, etc. in which a collection of trees consisting of one of each kind is cultivated'. That sounds safely humble, innocuous and inexpensive. Trees look after themselves and the upkeep of an arboretum should thus be almost nominal, or so it might have been hoped. However, Arnold's trustees had more ambitious aims. The deed of foundation stated that the Arnold Arboretum 'shall contain, as far as is practicable, all the trees, shrubs and herbaceous plants, either indigenous or exotic, which can be raised in the open air at the said West Roxbury . . . each specimen thereof shall be distinctly labelled, and to have the support of a professor, to be called the Arnold Professor, who shall have the care and management of the said Arboretum'. All this was to come out of less than $3,000 a year! Good Bostonians, the trustees evidently looked for a good return on their money.

Arnold's trustees can be readily excused for their supposed ignorance about the functions and potentialities and cost of an arboretum. Founding an arboretum then was a new American activity, almost an un-American activity, but one made acceptable, respectable and indeed desirable by such worthy New England families as the Hunnewells and the Sargents. It was an imported concept. The reason is really quite simple. Trees, like clean water and clean air, are taken for granted until almost lost. The concept of an arboretum, which has reached its highest and most elaborate development here at the Arnold Arboretum, took shape outside America at a time when there were too many trees in New England and too few in Old England, increasingly destroyed in the one, increasingly planted in the other.

Destruction of English Woodlands in 16th and 17th Centuries and Consequent Timber Shortage

The trees of England, down to the reign of Henry VIII, i.e. 1509–1547, supplied timber enough for the country's needs. Thereafter, with vastly increased consumption for gun-founding and ship-building, wherein oaks had so important a part, trees were cut down more rapidly than they were replaced. During the reigns of Henry's successors and especially during the English Civil War and the subsequent Commonwealth of 1649–1658, the pace of destruction quickened, as the demands for wood for building and domestic and industrial fuel rose, and there resulted a dangerous shortage of the right kind of home-grown timber. According to Stapledon (1935), the state forests in 1608 were assessed as having about 124,000 trees fit for naval use but in 1707 there were only about 12,500 trees available to meet needs which had grown so much greater. Timber shortage and inability to control dry rot in ships could then easily affect the balance of power for maritime nations (cf. Albion, 1926; Ramsbottom, 1937). In 17th- and 18th-century England they became matters of grave concern. Deserted by human beings for a hundred years, England would become as covered with trees as are the farms of New England left derelict for the last century. This has been indicated by the Broadbalk Wilderness experiment at the Rothamsted Experimental Station, Hertfordshire; here an area of cornfield left completely untouched since 1882 has now become a mature woodland of oak, ash, sycamore and hawthorn with some trees over 60 feet high. To be undisturbed, however, has been the fate of very little woodland in Britain and Ireland for many many years. King Henry VIII was not only interested in chopping off the heads of his discarded wives and chancellors. He was also interested in chopping down trees to make guns and gunpowder for fighting the French; his warships were the first to mount heavy cannon within the ship to deliver an effective broadside. In both activities he effectively used the Church of his times. He chose a parson, William Levett, to take charge of gun-making in Ashdown Forest, and a very good job he made of it, according to the economic historians. 'The event', Cipolla has said, 'marked the beginning of a prosperous era for the iron industry in Sussex and opened a new chapter in the history of artillery'. It also marked the beginning of the end of much English woodland. Thereafter the English not only made guns for their own use, they developed an export trade, and to stoke their foundries with charcoal they felled and burned the oaks, which the ship-builders and house-builders also needed. Cutting down 300,000 tons of timber a year, without plans for replanting, sounds like the North American lumber business in its 19th-century heyday, with Arnold and his fellow-merchants on the make, but this was in 17th-century England.

The Civil War of 1642–1646 made matters here far worse; the Parliamentarians controlled the southern woodlands and their foundries, and during the war and subsequently these were ruthlessly exploited. By 1660, when King Charles II returned, the old forests were largely gone; as in later America, nobody had bothered to replant, because quick and easy profits are not gained that way.

A calculation published by William Marshall in 1785 illustrates the heavy demands made upon English woodlands by the Navy: 'When we consider the prodigious quantity of timber which is consumed in the construction of a large vessel, we feel a concern for the probable situation of this country at some further period. A seventy-four gun ship (we speak from *good* authority) swallows up nearly, or full, three thousand loads of Oak timber. A load of timber is fifty cubical feet; a ton, forty feet; consequently a seventy-four gun ship takes two thousand large well-grown timber trees, namely trees of nearly two tons each'. Thus, after the Restoration, John Evelyn and his contemporaries had good cause to advocate large-scale replanting.

John Evelyn and The Influence of His 'Sylva'

Naval timber having thus become alarmingly short, the newly founded Royal Society of London held a symposium in 1662 on this unacademic but economically and politically important subject, which led John Evelyn (1620–1706) to publish in 1664 his *Sylva, or a Discourse of Forest-Trees, and the Propagation of Timber in His Majesties Dominions*, dedicated to King Charles, 'Nemorensis Rex'. The fruit of Evelyn's travels on the Continent as well as in England, of his observations, learning and patriotism, it stands among the most influential of all books on trees, their characters, history, uses and cultivation. It sold over one thousand copies in two years and these copies, many of them, went into the hands of the land-owning gentry and aristocracy of England. They took its teaching to heart. Apparently, by the time of Evelyn's death, several million more planted trees were spread over the English countryside, but there could be no quick recovery. His book passed into many editions, and its title has been incorporated into that of many later works, notably the most grandiose of American dendrological publications, the superb *Silva of North America* (1891–1902) by Charles Sprague Sargent of the Arnold Arboretum.

John Evelyn was a Royalist who travelled abroad for some years during the Commonwealth, and he was naturally very critical of what he found on his return. The improvident wastage and excessive short-sighted exploitation of English woodland especially appalled him, since, as he wrote, 'our *Forests* are undoubtedly the greatest Magazines of the *wealth* and glory of this Nation; and our *Oaks* the truest oracles of the perpetuity of our happiness, as being the only support of that Navigation which makes us fear'd *abroad* and flourish at *Home*'. His aim in writing his book was to help ensure that 'such woods as do remain intire be carefully preserv'd, and such as are destroy'd, sedulously repair'd'. This loss of woodland he correctly attributed to various causes; destruction had been due not only to 'the late increased *Shiping* alone, the multiplication of *Glass-works, Iron-furnaces*, and the like from whence the impolitick diminution of our *Timber* has proceeded, but from the disproportionate spreading of Tillage'. However, he particularly deplored the 'exorbitance and increase of devouring Iron-mills', for which in those days coal could not be used. His attitude towards conservation of national resources by exploiting those of other people has now become commonplace among the developed nations of the world. 'Twere better to purchase all our *Iron* out of America, then thus to exhaust our woods at home', particularly as the New English 'are now become very numerous and hindred in their advance and prospect of the Continent by their surfeit of the woods we want'.

The continuing destruction of trees had also unforeseen biological side-effects. Crops in East Anglia, a predominantly arable area, suffered early in the 18th century from depredations on a very large scale by grubs of the cockchafer beetle (*Melolontha melolontha*). The Norfolk naturalist William Arderon (1703–1767) in a letter to Henry Baker (cf. Whalley, 1971: 37) made the following observation: 'I have heard some ingenious persons endeavour to account for the large increase of these insects from the decrease of Rooks in this county which they say greedily devour them in their grub state and that the decrease of these birds hath been occasion'd by most of the antient Rookeries having been destroyed by the large fall of timber trees which hath forced those birds to remove to other parts of the Kingdom'. Rooks nest only in tall trees.

Evelyn was undoubtedly an effective propagandist because, as with population increase today, the dire effects of doing nothing were becoming all too evident.

Bishop Compton's Arboretum at Fulham

Among those inspired by Evelyn's enthusiasm must have been Henry Compton (1632–1713), Bishop of Oxford, then from 1675 to 1713 Bishop of London. The Bishop had been a soldier for a short time in his early years and was an enthusiastic gardener in his later years. Evelyn heard him preach at Oxford in 1673 and noted 'This worthy person's talent is not in preaching'! According to Pulteney (1790), 'he joined to his taste for gardening, a real and scientific knowledge of plants; an attainment not usual among the great, in those days'. His zealous Protestantism having brought him into conflict with pro-Catholic King James, who suspended him from his episcopalian functions in 1686, Compton retired to the Bishop's Palace at Fulham by the River Thames and continued his planting of trees and shrubs. In 1751 William Watson surveyed the episcopal domain at Fulham and listed the trees and shrubs still remaining in Compton's arboretum (see Appendix) despite long neglect, having 'endured our rude winter, some of them, for almost a century' and grown into the largest specimens in Britain and maybe in Europe. They were measured by Lysons in 1793 and 1809, and by Loudon in 1835 (cf. Loudon, 1838, 2: 43). As Watson stated, 'Dr. Henry Compton, heretofore bishop of London, planted a greater variety of curious exotic plants and trees, than had at that time been collected in any garden in England'. This excellent prelate presided over the see of London from the year 1675 to 1713, during which time, by means of a large correspondence with the principal botanists of Europe and America, he introduced into England a great number of plants but especially trees, which had never been seen here before, and described by no author; and in the cultivation of these he agreeably spent such part of his time as could most conveniently be spared from his other arduous occupations'. His activities and correspondence were certainly not wholly botanical and horticultural. He was among those who plotted the overthrow of King James and who invited William and Mary from Holland in 1688; with 40 horsemen he escorted Princess Anne (later Queen Anne) northward out of her father's reach and he later marched into Oxford, naked sword in hand, as the colonel of 200 volunteers. He then returned to the care of his garden and arboretum at Fulham. The North American genus *Comptonia* appropriately commemorates him. Bishop Compton's relevance to the history of the Arnold Arboretum is that he appears to be among the first to plant a large collection of trees and shrubs for interest and amenity rather than for economic purposes; as a pioneer arboretum founder he set an example increasingly followed during the 18th century and he readily made his plants available for study. Compton died in 1713 at the age of 81.

Old English Parks

Long before Bishop Compton's time, English landowners had possessed parks, some going back to the year 1200. As stated by Cantor (1965; cf. also Crawford, 1953, Patten, 1971), a typical medieval park 'consisted of an area of woodland and pasture enclosed by an earth bank often with an inside ditch. The bank was topped by a wooden paling fence, the whole forming an impassable barrier to the deer enclosed in the park . . . The primary purpose of the park was to retain the wild animals, principally deer of the red, fallow and roe varieties, which provided the landowner with sport and with fresh and salt meat'. These parks were essentially enclosed game preserves, but they also provided timber and pannage, since pigs fattened on the acorns of their oaks. They ranged in size from 30 acres to above 600 acres, such as Chillingham Park, Northumberland, which enclosed, from the 13th century onward, not only red deer and fallow deer but a herd of the wild white cattle, still surviving there though inbred for 700 years (cf. Whitehead, 1953). The chronicler Raphael Holinshed stated in 1578 that 'in evry shyre of England there is great plenty of parks, whereof some here and there appertaine to the Prince [i.e. the Crown] and the rest into the nobilitye and gentry'. Remnants of earthworks, once enclosing deer parks now vanished, still occur here and there in the English countryside (cf. Crawford, 1953). The disappearance of the forests in the 17th century led to greater interest in managed woodland as a source of future wealth and to increased planting of trees within such parks. In the 17th and 18th centuries the English deer park was developed into a planned landscape and gave rise in time to a specialized development, the arboretum. The older parks probably contained only hunting lodges or adjoined a castle, but the main feature of the newer parks was a great house standing in isolation and dominating by its size and elevated position an area of grassland dotted with clumps of trees or widely spaced individual trees. The park was the production in a northern climate of a kind of savanna providing fodder and shelter for game and grazing animals. Miles Hadfield (1960) attributes to the Englishman's love of solitude this 'placing his house in the centre of a park, well away from his fellows, or in an elevated position so that he might enjoy the view and the air, and at the same time be observed only from an unembarrassing distance', but by separating their stately residences from the abodes of lesser creatures the English landed classes also expressed their feeling of superiority. The older parks consisted essentially of rough uneven land not particularly suited to intensive arable cultivation, certainly not to the open-field strip cultivation usual in much of England before the Enclosure Acts. To make parks around the mansions built in the 18th century, arable farm land was sometimes taken out of tillage and converted to pasture; even villages were moved so as to be a proper distance from the great house and not to blemish the view! The parklike quality of part of the English countryside, which we are now destroying, is much of it a legacy from the 18th and early 19th centuries. To quote Hadfield (1960) yet again, 'the rising class of industrialists, merchants and new rich from India and North America sought political power, pleasure and gentility through the building or acquiring of country houses. Soon, in spite of the vulgar taint of trade, they were in a position equal to — and often financially sounder than — the inheritors of the old parks and country seats'. Something of the same attitude prevailed among wealthy New England families. Without it there would probably be no Arnold Arboretum today.

Importance of Trees as Part of Landscape

Trees formed an essential part of parkland scenery and evidently an appreciation of their value in the landscape influenced the placing of them as interest in landscape and in landscape painting quickened. The planting of trees was an act of faith, of creative imagination and of confidence in the future of the estate, for few of the men who put in the little trees could hope to enjoy the sight of their maturity or to fell them for profit. There thus arose an interest in trees not simply as masses of timber within woods but also as isolated elements having individually an aesthetic value. In the 18th century such an interest among the aristocracy communicated itself, possibly through social emulation, down to local squires.

This attitude towards trees arising out of heightened sensitivity for landscape was well expressed by the cultured and scholarly Herefordshire squire, Sir Uvedale Price (1747–1829), in his celebrated *Essay on the Picturesque* (1794): 'It is in the arrangement and management of trees that the great art of improvement consists; earth is too cumbrous and lumpish . . . But trees, detaching themselves at once from the surface, and rising boldly into the air, have a more lively and immediate effect on the eye. They alone form a canopy over us, and a varied frame to all other objects, which they admit, exclude and group with, almost at the will of the improver. In beauty, they not only far excel everything of inanimate nature, but their beauty is compleat and perfect in itself, while that of almost every other object absolutely requires their assistance: without them, the most varied inaequality of ground; rocks and mountains; even water itself, in all its characters of brooks, lakes, rivers, cataracts, is cold, savage and uninteresting. . . . trees are almost indispensibly necessary to picturesque and beautiful scenery. The *infinite variety* of their forms, tints, and light and shade must strike everybody; the quality of *intricacy* they possess, if possible, in a still higher degree, and in a more exclusive and peculiar maner. Take a single tree only, and consider it in this point of view. It is composed of millions of boughs, sprays, and leaves, intermixed with and crossing each other in as many directions, while through the various openings the eye still discovers new and infinite combinations of them: yet, what is most surprising in this labyrinth of intricacy, there is no unpleasant confusion; the general effect is as simple as the detail is complicate, and a tree is perhaps the only object where a grand whole (or at least what is most conspicuous in it) is chiefly composed of innumerable minute and distinct parts'.

This attitude, this feeling for the picturesque with trees as a dominant element in scenery, has its parallel in landscape painting, quite a relevant matter because the aristocracy bought and hung the pictures and cannot but have had their taste somehow influenced by them. To quote Sir Kenneth Clarke (1949), 'in the greatest ages of European art, the age of the Parthenon and the age of Chartres cathedral, landscape did not and could not exist. It is only in the seventeenth century that great artists take up landscape painting for its own sake and try to systematise the rules. Only in the nineteenth century does it become the dominant art'. Whereas, during the earlier period, trees in a painting were mostly rendered conventionally as background material for human figures, painters in the 18th and 19th centuries, notably John Constable, observed an individuality in trees interesting enough for specific portrayal, a subject discussed by Hadfield in 1960. Constable's 'Study of the Trunk of an Elm Tree' (Victoria and Albert Museum, London) is particularly detailed and realistic; oaks, elms and willows, mostly sketched in Helmingham Park, Old Hall Park, East Bergholt, Suffolk, and at Hampstead, form essential elements in many of his paintings. Such an interest in the individuality of trees underlies the whole concept of an arboretum.

English parks for all their social prestige were by no means purely recreational landscape areas. They had a definite utilitarian function in the rural economy. As already mentioned, they provided grazing for sheep, cattle, and sometimes deer, which could find cool shade beneath their trees in hot weather, and ultimately they provided timber, of which the most important was the English oak. The comparison, made above, of the Arnold Arboretum to an oak rather than to some other long-lived impressive tree is a deliberate association, because between the two there seems a linkage not entirely figurative. They connect through a peculiarity of growth of the English oak (*Quercus robur* L. sensu stricto, *Q. pedunculata* Ehrhart) formerly very important. The main growth bud of a shoot may be at an angle from the main shoot; the result can be the development of very angular, curved or oddly bent branches providing angled timber much stronger and more resilient to strain than could be achieved by jointing and these branches were accordingly valued formerly in ship-building and house-building. Oaks develop such branches best when given room to spread. Evelyn, of course, knew this as did his contemporaries: 'they require room, and space to amplifie and expand themselves, and would therefore be planted at more remote distances, and free from all encumbrances'. Parkland was thus the ideal environment for the oak; the oak was the ideal parkland tree. It does not seem far-fetched to regard the development of English park scenery as being strongly influenced by an understanding of the importance of spacing oaks.

Introduction of Trees and Shrubs From North America

During the 18th century some landowners interested in the embellishment of their parks sought diversity by the introduction of exotic trees, particularly from eastern North America. Obtaining plants and seeds was at first a haphazard affair dependent on the goodwill of distant and probably uninterested correspondents. As Peter Collinson (1694–1768) the London cloth merchant wrote: 'My Publick Station in Business brought Mee acquainted with Persons that were Natives of Carolina, Virginia, Maryland, Pensilvania, and New England. My Love for New & Rare Plants putt Mee often on Soliciting their assistance for seeds or Plants from those countries. I used much importunity to very little purpose . . . What was common with them (but Rare with us) they did not think worth sending'. Eventually, however, Collinson obtained the help of John Bartram of Philadelphia, Pennsylvania, and formed a syndicate, having Lord Petre and Philip Miller among its earliest members, which ultimately comprised 57 subscribers. Herbaceous plants naturally predominated in Bartram's shipments but he evidently also sent seeds of woody plants. The great interest in these not only in Britain but also on the Continent of Europe led Gregor Kraus in 1894 to designate the years 1687 to 1772 as the period of North American trees and shrubs (Die nordamerikanische Gehölze) in the history of the introduction of plants into European botanic gardens.

Dendrological Literature

Concurrent with this introduction of exotic plants and stimulating by example an interest in trees were the large-scale plantings of trees by noblemen such as Viscount Weymouth who planted the American white pine or Weymouth pine (*Pinus strobus*) extensively on his Longleat estate, Wiltshire; by Lord Petre who in 1741 and 1742 'planted out forty thousand trees of all kinds, to embellish the woods at the head of the park' at Thorndon, Essex (cf. Ramsbottom, 1938); and by the two Dukes of Atholl who planted larch (*Larix decidua*) at Dunkeld and Blair in Scotland. This interest stemming from Evelyn's

Sylva in its various editions led also to the formation of more arboreta containing a diversity of trees. Two particularly notable collections were those planted by Archibald Campbell, Duke of Argyle, at Whitton, Middlesex in 1720 and by Archibald Russell, Duke of Bedford, at Woburn Abbey, Bedfordshire. A specialized development of the arboretum was the pinetum, a collection of conifers, one of which started in 1795 by Lord Grenville at Dropmore, Buckinghamshire, had by 1834 become the most comprehensive in Europe; it still exists, with a Douglas fir (*Pseudotsuga menziesii*), raised in 1829 from Douglas's 1827 seed, now 31m high (cf. Mitchell, 1963). All this stimulated the production of dendrological works, the most important of these being the *Arboretum et Fruticetum Britannicum* (1838) in 8 volumes by John Claudius Loudon (1783–1843). This monumental encyclopaedic work must always command admiration and respect for its astonishing wealth of detailed accurate information about every kind of hardy tree and shrub until then introduced into Britain; the first volume, moreover, contains an invaluable historical account and survey of arboreta and the introduction of woody plants into cultivation.

It would seem indeed as if the massiveness of trees inspires their devotees to massive undertakings, for Loudon's work has had such worthy successors as Sargent's *The Silva of North America* (1891–1902) in 14 volumes; his *Manual of the Trees of North America* (1905 and 1921); C. K. Schneider's *Illustriertes Handbuch der Laubholzkunde* (1904–12) in 2 volumes; H. J. Elwes & A. Henry's *The Trees of Great Britain and Ireland* (1906–13) in 7 volumes; W. J. Bean's *Trees and Shrubs hardy in the British Isles* (1914) in 2 volumes, with a new 4-volume edition in course of publication; A. Rehder's *Bradley Bibliography* (1911–15) in 4 volumes; as well as his *Manual of cultivated Trees and Shrubs* (1927 and 1940); his *Bibliography of cultivated Trees and Shrubs* (1949); and G. Krüssmann's *Handbuch der Laubgehölze* (1959–62) in 2 volumes. Loudon, a follower of Humphry Repton (1752–1818), was profoundly interested in landscape gardening, for which woody plants are basic material, and his influence extended across the Atlantic, helping to form the ideas and methods of Andrew Jackson Downing (1815–1852), his assistant Calvert Vaux (1824–95) and the latter's partner for a time Frederick Law Olmsted (1822–1903), who laid out the grounds of the Arnold Arboretum.

Thus early in the 19th century the concept of the arboretum as a collection of trees and shrubs grown for their intrinsic interest and the allied concept of the planned landscape as a setting for the country seat of the wealthy landowner had become firmly established and had spread over the Continent of Europe. In Britain they were often united, and from here they later crossed the Atlantic to flourish in New England.

Trees in Eastern North America

Meanwhile, what of eastern North America and in particular New England?

The Pilgrim Fathers landing here in 1620 found not diminishing woods as in their abandoned homeland but appalling vast and seemingly endless virgin forests of tall trees. They did not much appreciate them and they soon acquired the pioneer's belief that the best tree is a felled one. Their effect on the forests is all too evident. What of the effect of the forests on them? or, as John Updike asked in 1955 when parodying the magazine *Life*'s issue on the American woman, 'The American Man, What of Him?' Obviously this question is best answered by Updike himself, in the simple sober prose characteristic of American journalism: 'Things were not always easy for the American Man. He came here in his water-weathered ships and did not find broad throughways, "cloud-capped towers" and a ready-made Free Way of LIFE. No, what he found confronting him in the fabled New Land was, principally, trees. Virgin, deciduous, hundreds of feet taller than he, the trees of the Colonization left their scars on his mental make-up in the form of the high rates of alcoholism, suicide, and divorce that distinguish him from the men of Continental Europe or Australia. While his brethren of the Old World were dangling perfumed coquettes on their silk-garbed knees he was forging inward . . . while his woods-tested faith . . . took on a new austerity and became Evangelical Methodism'.

Nothing therefore could have been more remote from the thoughts of the founding fathers of New England than to found a New England arboretum. Their main concern was to get rid of trees, thus establishing a tradition which their descendants and successors have followed with ever greater efficiency.

By the 18th century a landed class with many of the attributes of the landed ruling class of England and often emulating this had become established in the eastern American colonies, the Old Thirteen. Its members too possessed extensive manors and had come likewise to prize trees in a domestic landscape, which in 18th-century Virginia would be dotted with native American trees, such as oak, tulip-tree, magnolia, redbud, etc. Washington, for example, records in his diary the planting of many trees and shrubs, mostly American, for amenity and use. Jefferson on his two months' visit to southern England took the opportunity of visiting and studying the most celebrated gardens and parks there, significantly noting that in his own Virginian park the aspect was to be broken by clumps of oaks, elms and other native trees, as 'the open grounds of the English are broken by clumps of trees'. All these, of course, were private estates. A landmark in the extension of such ideas of landscape design to public land was the establishment in 1831 of the Mount Auburn Cemetery, near Boston, under the leadership of Jacob Bigelow and under the care of the Massachusetts Horticultural Society, with some 80 acres laid out as a landscape garden having groups of trees and shrubs. This preceded the public park at Birkenhead, Cheshire, England, laid out by Joseph Paxton in 1844, which so strongly influenced Olmsted. Later Andrew Jackson Downing, already mentioned as influenced by Loudon, published his *Treatise on the Theory and Practice of Landscape Gardening* (1841) and began the movement for public parks in America. Among those he advised on layout and planting was Henry Winthrop Sargent (1810–1882), the uncle of Charles Sprague Sargent. Henry Sargent travelled in Europe in 1847 to 1849 and planted a pinetum on his Wodeneth estate by the Hudson River. Downing's most important disciple was Frederick Law Olmsted (1822–1903), perhaps the greatest of American landscape architects, sometime farmer, sailor, surveyor and journalist, who in 1850 travelled on foot through Great Britain. Significantly, he noted in his *Walks and Talks of an American Farmer* (1852) that 'there is probably no object of art that Americans of cultivated taste generally more long to see in Europe than an English park'. The wealthy landed men of New England took readily to these ideas adopted from Repton and Loudon and developed by Downing and Olmsted. Thus Horatio Hollis Hunnewell in 1851 set out on his 40 acres, which included a pinetum, to test a diversity of trees and shrubs near Boston.

In this way, over the years, the English-style landscape park became transferred to New England. As stated by Stephanne Sutton (1970), 'from Boston to Newport, from the banks of the Hudson to Philadelphia and Delaware, were acres of elegant — sometimes pretentious — private parks and gardens', 'all immodestly calculated to arouse envy and admiration'. An interest in the diversity of trees and shrubs for planting and the establishment and maintenance of such large grounds had become part of the way of life of the wealthy New England society into which Charles Sprague Sargent was born in 1841 and through him these became basic influences on the development of the Arnold Arboretum. Without them it would never have taken the shape it did; indeed without them it might never have been founded at all. This background made certain courses of action seem reasonable, desirable and possible to Sargent. The estates of such men as H. W. Sargent and H. H. Hunnewell provided examples of what could be achieved under the climatic conditions of New England. C. S. Sargent's character and ideals, thus directed, in their turn shaped and largely created the Arnold Arboretum.

Charles Sprague Sargent

Thanks to the very informative and well-documented publications on Sargent by Stephanne Sutton, we can picture the man and appreciate how his aggressive, and to him natural, exercise of power overcame the many difficulties which faced him. As she says, 'he did not possess a democratic soul. He was haughty, stern, abrupt, stubborn, and sometimes tactless; he was also strong, clever, relentless, a good judge of men, and wealthy. What he lacked in scientific experience at the beginning of his career, he compensated for with administrative imagination and money'. By birth and upbringing Sargent belonged to the upper level of New England society. His creed was that of the proper Bostonian: 'I believe in the Fatherhood of God, the Brotherhood of Man and the Neighbourhood of Boston'. A Doctor of Divinity of the University of Cambridge, England, assures me that there is no Biblical authority for all this but that it can be accepted as an act of faith based on later revelation, to the enlightened. Otherwise in many ways Charles Sprague Sargent was an Old England landed gentleman in a New England setting. He had much in common with such a representative of the English aristocracy as John Russell (1766–1839), 6th Duke of Bedford, and of the English landed gentry as Henry John Elwes (1846–1922). The Duke of Bedford developed the arboretum of Woburn Abbey, Bedfordshire; he sponsored important botanical works by his gardener James Forbes (1773–1861), among them *Salictum Woburnense; or a Catalogue of Willows in the Collection of the Duke of Bedford at Woburn Abbey* (1829) and *Pinetum Woburnense; or a Cata-*

logue of Coniferous Plants in the Collection of the Duke of Bedford at Woburn Abbey (1839); he also took an important part behind the scenes in saving the Royal Botanic Gardens, Kew for development into a major botanical institution which in turn influenced the development of the Arnold Arboretum. Elwes, a keen much-travelled naturalist and arboriculturist, produced, in collaboration with Augustine Henry, *The Trees of Great Britain and Ireland* (1906–13). An important characteristic of the ruling class, to which they belonged, was their assurance not only in their own personal position within society but also in the continuing existence of their class, their power, their land and their possessions. Thus they developed their estates, made vast changes in their landscapes and planted trees even more for their posterity than for themselves. As Miles Hadfield (1960) has remarked, 'to us, who see the great trees lying conformably on the contours, the winding lakes, and the now decaying temples, the scene can have none of the immense significance that it had for those who saw only skinny saplings, the newly turned banks, the bare verges of freshly cut ornamental waters and the shrines of new masonry'. Looking forward to future maturity through slow development was part of the confidence of Sargent's social group and in such confidence he created the Arnold Arboretum.

Another mark of the ruling class which values its possessions and intends to have and to hold them is its choice of able men from much lower social non-competitive strata to manage its affairs and to serve its ends. A ruling class survives only through the faithfulness and ability of its servants. The maintenance of the old estates depended on capable bailiffs, agents, overseers, head gardeners and keepers. That the Arnold Arboretum developed into such high repute was in no small way due to Sargent's judgment in choosing his men, C. E. Faxon, Alfred Rehder, E. H. Wilson and J. G. Jack, loyal poorly paid servants of great ability who trusted Sargent the autocrat and in turn received his trust and support, all in one way or another adding lustre to the Arnold Arboretum.

Yet another mark of the old ruling class was its sense of quality, of contempt for the second-rate, possessing as it did the means as well as the desire for the best. In Sargent's case this is very evident in the publications coming from the Arnold Arboretum during his reign, above all in *The Silva of North America*, with its excellent typography and its exquisitely drawn and engraved plates, a very costly work but one of lasting utility and beauty. Thus he established a proud tradition.

Conclusion

The conditions which led to the foundation of the Arnold Arboretum in New England a hundred years ago have, as has been explained above, their roots in Old England some two hundred years or so before that, when from the medieval parks with their spaced oak trees there developed the landscaped park as a setting for a stately residence and from the anxiety caused by the ruthless destruction of the old woodlands there came a surge of tree planting and an interest in trees for their diversity and amenity leading to the concept of the arboretum, with emphasis shifting from their economic to their aesthetic and ultimately their scientific aspects. The Arnold Arboretum has, however, had a development unparalleled by its Old World and its New World predecessors. It has become an institution where woody plants are not only grown in diversity but are scientifically studied. The Duke of Bedford encouraged the study of his trees and shrubs at Woburn Abbey and thereby sponsored two notable books, the *Salictum Woburnense* and *Pinetum Woburnense*, but these were private isolated pieces of dendrological scholarship, resulting from the happy but unusual and not repeated collaboration of a scientifically minded duke and a scientifically minded gardener. When one studies the history of botanic gardens of the past, with which arboreta have often been associated, one finds a high mortality rate. Those which have survived have always been attached to a centre of botanical learning, as, for example, the botanic gardens at Oxford, Edinburgh and Cambridge, or have become centres of botanical learning in their own right, as the Royal Botanic Gardens, Kew. The Arnold Arboretum has had a curiously anomalous position. Although legally attached to a major centre of botanical learning, Harvard University, it has nevertheless for over half its history been somewhat like a New England version of Kew but restricted to the cultivation and study of woody plants. It would seem to be the first institution anywhere thus devoted to dendrology and arboriculture as distinct from forestry and general taxonomic botany. This specialization which won the Arnold Arboretum its unique place of honour among botanical institutions was Sargent's doing. Inhabitants of Boston and Cambridge could enjoy its plantings of trees and shrubs; botanical scholars everywhere could use with profit its erudite publications. Sargent and his collaborators established its international reputation and their successors have worthily maintained this. Those who plant trees need long views; they must be imbued with hope and confidence that their efforts will bring rewards to later generations. Those who study them need patience, tenacity, industry and ability in good measure. Such qualities manifest in those who serve the Arnold Arboretum today a hundred years after its foundation provide the best augury for its future.

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Appendix

> [The following account by William Watson (1715–1787) of the trees remaining in 1751 from Bishop Compton's planting at Fulham Palace, the residence of the Bishop of London, is reprinted below from the *Philosophical Transactions* of the Royal Society of London, vol. 47: 241–247 (1753). The accepted binomial names for the species listed have been added [in square brackets] on the assumption that Watson applied the pre-Linnaean names correctly. Loudon in 1835 computed the height of *Quercus suber* (no. 32) at 50 ft., *Q. ilex* (no. 16) at 50 ft., *Q. alba* (no. 27) at 70 ft. and *Juglans nigra* (no. 23) at 40 ft.]

An Account of the Bishop of London's *Garden at* Fulham; *by Mr.* William Watson, *F. R. S.*

To the Royal Society:

Gentlemen,

I some time since communicated to you an account of what remained of the famous garden of John Tradescant at South Lambeth, which you did me the honour to receive favourably: Upon the strength of which I now lay before you the remains of that still more famous botanic garden at Fulham, wherein Dr. Henry Compton, heretofore bishop of London, planted a greater variety of curious exotic plants and trees, than had at that time been collected in any garden in England.

This excellent prelate presided over the see of London from the year 1675 to 1713; during which time, by means of a large correspondence with the principal botanists of Europe and America, he introduced into England a great number of plants, but more especially trees, which had never been seen here before, and described by no author: and in the cultivation of these, as we are informed by the late most ingenious Mr. Ray,* he agreeably spent such part of his time, as could most conveniently be spared from his other arduous occupations.

From this prelate's goodness in permitting with freedom persons curious in botany to visit his garden, and see therein what was to be found no-where else; and from his zeal in propagating botanical knowledge, by readily communicating to others, as well foreigners as our own countrymen, such plants and seeds, as he was in possession of, his name is mentioned with the greatest encomiums by the botanical writers of his time; to wit, by Herman, Ray, Pluknet, and others.

Mr. Ray,† in the second volume of his history of plants, which was published in the year 1688, gives us a catalogue of the rare and exotic trees and shrubs, which he had just before observed in the

* Hist. Plant. Tom. II. p. 1798.

† Cap. xi.

bishop's garden, which he at that time called *hortus cultissimus, novisque et elegantioribus magno studio nec minore impensa undique conquisitis stirpibus refertissimus.*

As this prelate's length of life and continuance in the see of London were remarkable, so we find the botanists, who wrote after Mr. Ray, most frequently mentioning in their works the new accessions of treasure to this garden; and of this you meet with a great variety of examples in the treatises of Dr. Pluknet, Herman, and Commelin.

Botanical, much more even than other worldly affairs, are subject to great fluctuations; and this arises not only from the natural decay of vegetables, and their being injured by the variety of seasons, but also from the genius and disposition of the possessors of them. So here, upon the death of bishop Compton, all the greenhouse plants and more tender exotic trees were, as I am informed by Sir Hans Sloane, given to the ancestor of the present Earl Tylney at Wanstead. And as the successors of this bishop in the see of London were more distinguished for their piety and learning, than for their zeal in the promotion of natural knowledge, the curiosities of this garden were not attended to, but left to the management of ignorant persons; so that many of the hardy exotic trees, however valuable, were removed, to make way for the more ordinary productions of the kitchen-garden.

I thought therefore, that the state of this garden, after the revolutions of much more than half a century since what Mr. Ray wrote thereof, would be an acceptable present, not only to the Royal Society, but to such persons likewise, as are curious in these matters.

A Catalogue of the exotic Trees remaining in the Bishop of London's *Garden at* Fulham, June 25, 1751.

[1] Abies foliis solitariis, apice acuminatis. Hort. Cliffort, 449. [= *Picea abies* (L.) Karsten]

[2] Abies taxi folio, fructu sursum spectante. Tourn. 585. The silver fir. [= *Abies alba* Miller]

[3] Acer platanoïdes. Munting. Histor. The Norway maple. [= *Acer platanoides* L.]

[4] Acer Virginianum, folio majore subtus argenteo, supra viridi splendente. Plukn. Phyt. Tab. 2. Fig. 4. The Virginian flowering maple. [= *Acer rubrum* L.]

[5] Acer maximum, foliis trifidis vel quinquefidis, Virginianum. Plukn. Phyt. Tab. 123. Fig. 4. The ash-maple, vulgo. [= *Acer negundo* L.]

[6] Arbutus folio serrato. C. B. P. 460. The strawberry-tree. [= *Arbutus unedo* L.]

[7] Benzoin, Boer. Ind. alt. II. 259. The Benjamin-tree. [= *Lindera benzoin* (L.) Blume]

[8] Cedrus Libani. Barrel. rar. Tab. 499. Cedar of Libanus. [= *Cedrus libani* A. Richard]

[9] Celtis foliis ovato-lanceolatis serratis. Hort. Cliff. 39. Lotus arbor. Caesalpin. [*Celtis australis* L.]

[10] Cupressus ramos extra se spargens, quae mas Plinii. Tourn. 587. The male cypress. [=*Cupressus sempervirens* f. *horizontalis* (Miller) Voss]

[11] Cupressus meta in fastigium convoluta, quae foemina Plinii. Tourn. 587. The female cypress. [= *Cupressus sempervirens* L.]

[12] Fraxinus florifera botryoïdes. Morris. Prael. Bot. 265. [= *Fraxinus ornus* L.]

[13] Fraxinus folio rotundiore. C. B. P. 416. The manna ash. [= *Fraxinus ornus* var. *rotundifolia* Tenore]

[14] Gleditsia. Gron. flor. Virgin. 193. Acacia Americana triacanthos, &c. Plukn. Mantiss. The honey-locust. [= *Gleditsia triancanthos* L.]

[15] Guaiacana, Pishamin Virginianum. Park. Hist. 918. The Virginian date plumb. [= *Diospyros virginiana*]

[16] Ilex oblongo serrato folio. C. B. P. 424. The evergreen oak. [= *Quercus ilex* L.]

[17] Juniperus Virginiana. Herman. Hort. Lugd. 347. The Virginian cedar. [= *Juniperus virginiana* L.]

[18] Laburnum majus, vel Cytisus Alpinus latifolius flore racemoso pendulo. Tourn. 648. [= *Laburnum alpinum* (Miller) Bercht. & Presl.]

[19] Larix folio deciduo conifera. J. B. Hist. I. 265. The larch-tree. [= *Larix decidua* Miller]

[20] Lilac laciniato folio. Tourn. 602. Cut-leaved jasmine, vulgo. [= *Syringa laciniata* Miller]

[21] Mespilus prunifolia Virginiana non spinosa, fructu nigricante. Plukn. Phyt. Tab. 46. Fig. 2. [= *Viburnum prunifolium* L.]

[22] Morifolia Virginiensis arbor, loti arboris instar ramosa, foliis amplissimis. Plukn. Phyt. Tab. 46. Fig. 2. Corylus maxima folio latissimo Virginiana, Raii Hist. 1799. [= *Corylus cornuta* Marshall]

[23] Nux juglans Virginiana nigra. Herman. Hort. Lugd. Tab. 453. The black walnut-tree. [= *Juglans nigra* L.]

[24] Pavia. Boer. Ind. alt. II. 260. The red horse-chesnut, vulgo. [= *Aesculus pavia* L.]

[25] Pinus sativa. C. B. P. 491. The manured or stone pine. [= *Pinus pinea* L.]

[26] Pinus Americana, foliis praelongis subinde ternis, conis plurimis confertim nascentibus. The cluster-pine. Rand. Hort. Chels. 156. [= *Pinus taeda* L.]

[27] Quercus alba Virginiana. Park. Theat. 1387. The white or Virginian iron oak. [= *Quercus alba* L.]

[28] Rhus foliis pinnatis serratis. Hort. Cliff. 110. Virginian sumach. [= *Rhus coriaria* L.]

[29] Robinia aculeis geminatis. Hort. Cliff. 354. Pseudo-acacia siliquis glabris. Boer. Ind. II. 39. [= *Robinia pseudoacacia* L.]

[30] Ruscus angustifolius fructu summis ramulis innascente. Tourn. 79. Laurus Alexandrina fructu e summitate caulium prodeunte. Herm. Hort. Lugd. 681. [= *Danae racemosa* (L) Moench]

[31] Siliquastrum. Tourn. 647. Cercis foliis cordato-orbiculatis glabris. Hort. Cliff. 156. Arbor Judae vulgo. [= *Cercis siliquastrum* L.]

[32] Suber latifolium perpetuo virens. C. B. P. 424. The cork-tree. [= *Quercus suber* L.]

[33] Terebinthus Indica Theophrasti. Pistachia foliis impar-ipinnatis, foliolis ovato-lanceolatis. Hort. Cliff. 456. The pistachia-tree. [= *Pistacis vera* L.]

These just now recited are the remains of that once famous garden; among which are some, that notwithstanding the present great improvements in gardening, are scarce to be found elsewhere. From the length of time they have stood, several of the trees are by much the largest of their kind I ever have seen, and are probably the largest in Europe. This account of them therefore is not merely a matter of curiosity; but we learn from it, that many of these trees, though produced naturally in climates and latitudes very different from our own, have grown to a very great magnitude with us, and have endured our rude winters, some of them, for almost a century: and that they in proper soils and situations may be propagated for advantage, as well as for beauty. For the exemplification of this I would recommend to the curious observer the black Virginian walnut-tree, the cluster-pine, the honey-locust, the pseudo-acacia, the ash-maple, &c. now remaining at Fulham.

I cannot conclude this paper, without testifying in this public manner my obligations to § the present bishop of London, who has with so eminent a degree of reputation filled those high stations, to which he has been called, not only for his repeated civilities to myself, but likewise for his assurances to me, that no care shall be wanting for the preservation of the very curious particulars mention'd in this catalogue.

I have the honour to be with the most profound respect,
Gentlemen,
Your most obedient servant,
W. Watson.

London, June 27,
1751.

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§ Dr. Thomas Sherlock.

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From Witch Doctor to Modern Medicine:
Searching the American Tropics for Potentially New Medicinal Plants

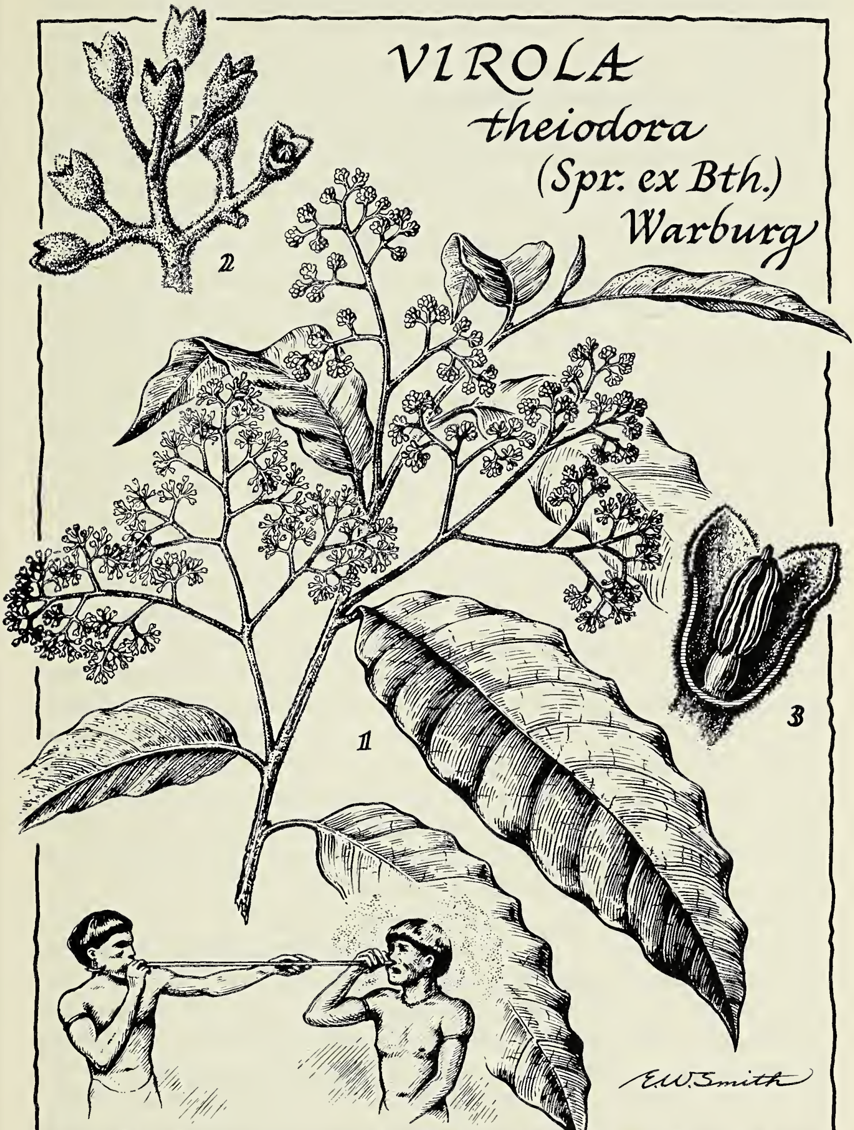
> "And as there are discouvered new Regions, new Kingdoms and new Provinces by our Spaniards, so they have brought unto us new Medicines, and newe Remedies, wherewith they do cure many infirmities, which, if we did lacke them, would be incurible, and without any remedie . . . for which cause I did pretend to treate, and to write of all things that they bring from our Indias, apperteyning to the Arte and Use of Medicine, and the remedie of hurtes and diseases that we doo suffer and endure . . .".
>
> Nicholas Monardes [transl. John Frampton] "Joyfull Newes out of the New-found World" (1596)

I.

The search for potential new medicines from the Plant Kingdom is not new. It has been carried on since man first became aware of the variety of effects that plants had on his mind and body. It is still under way. But we now have many advantages over man in all prior ages. We have millennia of experience behind us; a deeper understanding of what plants are and how they live; an intensity of modern technology to help us; and, what is more important than all of the other advantages, a determination to probe into the still virgin vegetal world for active compounds of promise for man's existence.

Today we follow several discreet paths in our search for "new" medicinal plants.

Some modern programs — ambitious, technologically complex and potentially promising — have emphasized the random or semi-random screening of plants from all parts of the world for new organic compounds. Emphasis lies usually in screening for a particular kind of compound: alkaloids, glycosides, etc. One such program, carried out over a ten-year period by an American pharmaceutical company, examined more than 40,000 species for alkaloids, bringing the number of known alkaloid-bearing plants to nearly 5,000. Although this kind of program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is costly, it is highly efficient. Alkaloids, for example, were unknown in 1800; in 1949, approximately 1000 were known; by 1959, 2175 were recognized; in 1969, the total number stood at 4350.

Another kind of screening stresses pharmaceutical activity instead of chemical constituency. Perhaps the best example of this type of program is that carried out by the Cancer Chemotherapy National Service Centre of the National Institutes of Health which has screened more than 8000 randomly collected species for antineoplastic activity and which still continues.

Governmental and private agencies undoubtedly will from time to time continue a variety of random samplings of the world flora, and these programs may be expected to yield more and better results with increasing sophistication of chemical and pharmacological techniques. As Farnsworth has said: ". . . in the light of present knowledge and experience . . . a random selection and testing of plants selected from a broad cross section of families and genera will prove of greatest value in attempts to discover new entities for the treatment of clinical malignancies".

Still another method of searching for new medicinal plants utilizes as a guide the ethnobotanical or herbalistic literature of the past. Programs based upon this method are costly in terms of the number of plants that can be investigated, but it is true that the literature of the past is voluminous and, except in isolated cases, has really not been systematically combed nor critically examined. There are many obvious drawbacks to the use of the older literature as the only guide for surveys: the exact identification of the plant in question may be, and more often than not is, open to serious doubt, and uncritical diagnosis of diseases negates the value of many, if not most, of the recommended medicinal uses of the plants.

The herbarium has recently been recognized as an unexplored repository of ethnobotanical references valuable in the search for new medicinal plants. There have been several surveys based upon reports of folk-medicine uses on the labels of specimens. The most inclusive of these surveys — conducted by Altschul — comprises a sheet by sheet examination of the 2,500,000 specimens in the Harvard University Herbaria. This survey, which uncovered 7,500 reports of interest, is at present in press. There is a wealth of ethnopharmaceutical knowledge in our world herbaria. Information stored away on herbarium labels represents first-hand observations made by the plant collectors themselves in the field. It is usually of much greater reliability than reports in the various kinds of literature. It was written down usually in the field when the report was learned, and, since the information is physically attached to a specimen, there can be no uncertainty about the identity of the plant.

Ethnobotanical research amongst extant and still viable primitive societies represents undoubtedly one of the best avenues for searching out promising new drug plants. It is not an easy nor a rapid method, but time and time again it has proved its effectiveness.

Knowledge or understanding of the medicinal uses of plants in primitive societies has been the subject of some of the most absurdly laudatory enthusiasm on the one hand, and of the most abjectly damning deprecation on the other. Some students may feel that man in primitive societies possesses a particularly penetrating perception of the attributes of plants, a perception denied to men of more advanced cultures; others have interpreted the many superstitious beliefs concerning plants and their properties to discredit absolutely all of the understanding of plants in primitive societies. We now know how much into error both points of view fall. A good — the best — example is provided by the discovery during the past forty years of a succession of so-called "Wonder Drugs" — almost all from the Plant Kingdom and almost all from plants with rich ethnopharmaceutical histories in aboriginal societies. The "Green Revolution" uncovered the unbelievable muscle relaxants from South American arrow-poisons or curares; antibiotics from moulds and other plants are now known to have been employed in the Egyptian Empire; rutin comes from a number of species, some of them with a wealth of ethnobotanical lore; cortisone is a gift from sapogenin-plants that were variously employed by natives in Central America and Africa; cytotoxic principles have been derived from *Podophyllum*, a plant that enjoyed sundry medicinal uses amongst the Indians of the Northeast; hypertensive agents from *Veratrum viridis*, a species first brought to the attention of researchers as a result of native uses; khellin comes from the *Ammi Visnaga* of the ancients; and we should not forget the many psychoactive agents from the hallucinogenic plants — cryptogams and phanerogams — of the New World Indians.

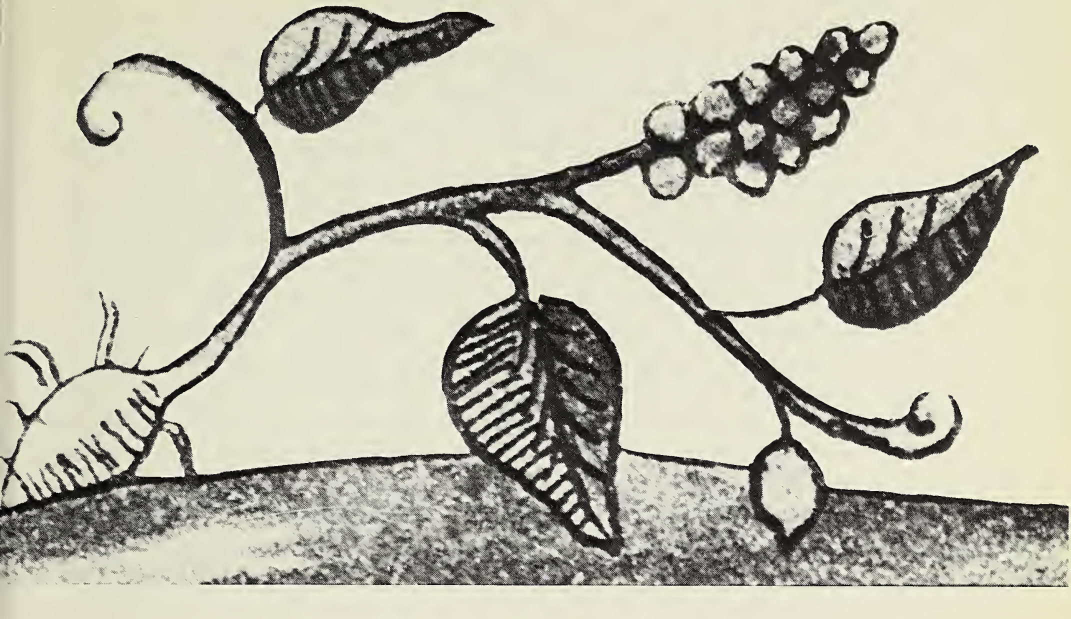
Not only have promising new drugs been won from these and other common plants. These native "medicines" have yielded many new organic substances and in addition wholly new categories of secondary organic compounds the existence of which was hitherto unsuspected. And all of these new chemical structures have provided science with novel bases on which the synthetic chemist may build even more interesting and possibly more promising organic molecules.

In the prosecution of our search for potential medicines from plants, we must examine and evaluate any pharmacological activity. How often has modern man come upon important and new products with uses totally different from those amongst the native peoples whose knowledge of a strange property possessed by the plant first called it to the attention of sophisticated research? Examples are legion. Who would have predicted that a valuable ophthalmic medicine — physostigmine — would be derived from a tropical African liana used as a dreaded ordeal poison to administer aboriginal justice? How fortunate for modern medicine that scientific inquisitiveness led modern investigators to look at the curares — plant preparations employed by South American Indians to kill, yet the source of alkaloids capable, in the hands of surgeons, of safeguarding life when used as muscle relaxants? And where would our intensive modern agriculture be without that greatest of weapons against insect plagues, rotenone, a compound discovered in leguminous plants utilized in primitive societies as fish poisons? Could we ever have dared predict that the intensely poisonous false hellebore, employed by certain North American Indians to choose a new chieftain through a dangerous and sometimes fatal intoxication of young braves, would yield a valuable hypertensive agent?

Wherefore it behooves the ethnobotanist and ethnopharmacologist to scrutinize all biodynamically active plants — even those which, according to aboriginal belief, are so toxic that they are studiously avoided. The most noxious poison may well turn out, in the hands of a proper investigator, to be a life saver.

How much more remains to be discovered by delving into primitive pharmacopoeias? Nay — how much *has* been discovered and which lies available to researchers but which apathy, neglect or disbelief born of our well established habit of prejudgment has kept from the searchlight of modern investigation?

Although ethnobotanical studies amongst living and intact aboriginal societies offers undoubtedly the best avenue of approach, there are not enough trained ethnobotanists to carry out the necessary investigations against the ever increasing



Ololiuqui (Rivea corymbosa), *as illustrated in the Paso y Troncoso edition (Codex Florentino) of the* Sahagún Historia de las Cosas de Nueva España.

rapidity of disintegration of primitive societies. Botanists are usually far too occupied with the work of collecting plants essential to their own monographic or floristic studies to devote the time and effort in the slow sleuthing essential to assembling the pieces of an ethnobotanical puzzle. They often do make observations of far-reaching value in indicating avenues for later extensive ethnobotanical studies. Too many botanists, however, have manifested definite hostility to and distrust in ethnobotanical investigation and have refused to heed native lore, even when it was easily available and obviously authentic. The anthropologist, likewise, has normally been so deeply committed to unraveling obscure or complex sociological enigmas that he is occasionally unable to signalize an important point of departure for the ethnobotanist. And the anthropologist is, unfortunately, often discouraged from the pursuit of proper ethnobotanical research because of the collection of voucher specimens, which has too often been portrayed by professional botanists as such a complex and burdensome chore as to be distasteful or even impractical for an anthropologist.

Inasmuch as there appears to be little hope for the immediate training of enough men specifically in ethnobotanical research, the botanist and, to a lesser extent perhaps, the anthropologist must take the initiative to tap the reservoir of knowledge amongst aboriginal peoples of the unusual pharmacological properties of the vegetal organisms of the earth. We can no longer afford the luxury of complacency. This priceless lore — much of it admittedly of limited or no practical value — is too ephemeral in the rapid changes that today swirl around all primitive cultures. We can no longer afford to ignore reports of any aboriginal uses of a plant merely because they seem to fall beyond the limit of our credence. To do so would be tantamount to the closing of a door, forever to entomb a peculiar kind of native knowledge which might lead us along paths of immeasurable progress.

Almost all of my own ethnobotanical search for plants of biodynamic activity which might indicate potential medical value has taken place in Mexico, the northern Andes or the western Amazon. In the approximately fourteen years that I spent in the hinterlands of South America, I collected more than 26,000 plants, a good portion of them with ethnobotanical annotations. The path from ethnobotanical discovery to the production of an accepted pharmaceutical product is long and more often than not does not arrive at a definitive ending. But the first steps in any search for potential new medicines must be the botanical and ethnobotanical. The wealth of plant lore of tropical American peoples has provided me with a large variety of very interesting biologically active plants, some of which are presently under phytochemical investigation, others of which will soon be subjected to analysis. A few of these plants are discussed below.

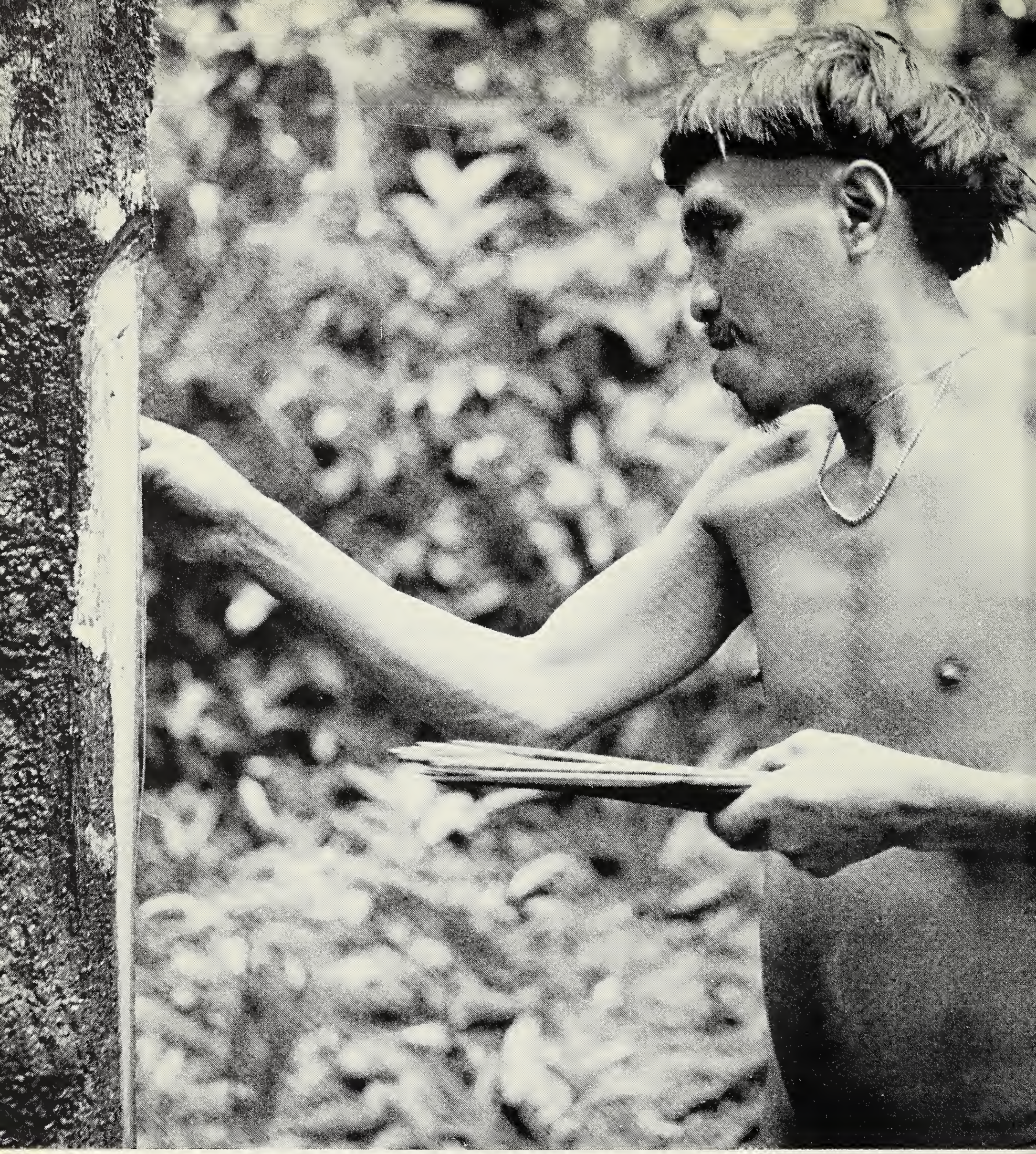
II.

In studying the "medicinal" plants of aboriginal peoples in the Americas, we must always bear in mind that those "medicines" with psychic powers are often much more important than those with purely physical properties. This apparent anomaly is easy to understand. Illness and death in primitive societies are attributed to the intrusion into the body of malevolent forces from the spirit world. Consequently, what more logical way of diagnosing and often even of treating illness than contacting these spirit forces? There is in the ethnopharmacopoeias of most American natives one or more plants capable, through a variety of hallucinations, of transporting the medicine man or even the patient to the realms where the spirits dwell and enabling one or both to communicate with the source of the evils. These plants, to which the Indian usually ascribes divine powers, are the hallucinogens or the psychotomimetics. They are the medicines *par excellence* of aboriginal America. And there are diverse indications that the active principles of some of them may, when thoroughly understood, become important in modern medicine in experimental, if not in therapeutic psychiatry.

The number of plants employed ceremonially as hallucinogens is vastly greater in the New World than in the Old. Some of the New World hallucinogens are well known and have been now for a century: peyote (*Lophophora Williamsii*) in North America; ayahuasca, caapi or yajé (*Banisteriopsis* spp.) yopo (*Anadenanthera peregrina*) in South America; and the species of *Datura* in Mexico, Central and South America. A surprising number — and some of those chemically most interesting — have but recently been botanically identified; and several have been discovered only during the past few years.

The ancient Mexicans ate hallucinogenic mushrooms which they called *teonanacatl* or "flesh of the gods". In 1941, the identification of *Panaeolus sphinctrinus* as one of these sacred narcotic fungi initiated the twenty-five year long field research which has resulted in the determination of at least two dozen species of mushrooms (species of *Psilocybe*, *Conocybe* and *Stropharia*) as the ceremonial hallucinogens of a number of modern Indian tribes, especially in Oaxaca. Phytochemical investigation of these intoxicating mushrooms has yielded psilocybine, a wholly novel kind of tryptamine with a phosphorylated hydroxyl radical — a structure not hitherto known from the Plant Kingdom.

In the same period came the definitive identification through voucher specimens of ololiuqui (*Rivea corymbosa*) — the narcotic morning glory so famous in early Aztec medical lore. And a few years later the discovery of another hallucinogenic convolvulaceous plant, *Ipomoea violacea* — enlarged our understanding of the use of the morning glories as sacred divinatory agents. Phytochemical studies succeeded in showing the unexpected presence in the seeds of these morning glories of ergoline alkaloids, principles closely related to the semi-synthetic lysergic



Waiká Indian extracting resin for painting arrows from Virola theiodora. *Tototobí, Territorio de Roraima, Brazil. Photo: R. E. Schultes.*

acid amide (LSD) and known elsewhere in the Plant Kingdom only in totally unrelated primitive groups of fungi, such as ergot, *Claviceps purpurea.*

Both the narcotic mushrooms and the hallucinogenic morning glories were well recognized in the ethnobotanical writings of the early Spanish conquerors of Mexico. We know much about their use by the Aztecs because of the long diatribes against their role in the pagan religions. But their use retreated to the hinterlands under the tremendous persecution, and they were lost to sight. In an attempt to identify teonanacatl and ololiuqui, modern botanists assigned them to other plants. Their correct identification took about four hundred years.

An ancient narcotic employed by the Indians of the American Southwest before the arrival from Mexico of peyote is the *red bean* or *mescal bean,* the bright scarlet seed of the leguminous shrub *Sophora secundiflora.* A highly dangerous narcotic because of its content of the poisonous alkaloid cytisine, the mescal bean fell into disuse as a ceremonial hallucinogen with the arrival of the relatively safe peyote cactus. Much of an ethnopharmacological nature must be learned about the mescal bean, a rather difficult task with its apparent demise as a religiously important plant.

Field work in Oaxaca during the past twenty years has identified several interesting narcotics: *Salvia divinorum* and two introduced Asiatic species of *Coleus* as sacred hallucinogens in the northeastern part of the state; two species of puffballs (*Lycoperdon* spp.) in the Mixtec country; and the composite *Calea Zacatechichi* amongst the Chontal Indians. The puffballs and the *Calea* are unusual in acting as auditory hallucinogens. The active principles in these psychotropic mints, the puffballs and zacatechichi are still unknown.

Similarly, we find that in South America such an important hallucinogenic snuff as *yakee, epená, nyakwana* or *paricá* — the basis of witch-doctoring and of ceremonies in the northwest Amazon and adjacent parts of the upper Orinoco basins — was unknown until the 1950's. We have recently learned that several species of the myristicaceous genus *Virola* — *V. calophylla, V. calophylloidea* and *V. theiodora* — are the basis of this snuff prepared from a red resin in the bark of these forest trees. Furthermore, the chemistry has been elucidated: the basic active ingredients are tryptamines, especially N,N-dimethyltryptamine and 5-methoxy-N, N-dimethyltryptamine.

The acanthaceous shrub *Justicia pectoralis* var. *stenophylla* is dried and pulverized as an aromatic additive to the snuff made from Virola. A plant with many uses in folk medicine because of its pungent fragrance, it has recently been said to be the source itself of an hallucinogenic snuff in the uppermost Orinoco basin of Venezuela.

The chemistry of several historically well known and long identified hallucinogens has recently been elucidated, showing that their psychoactive properties are likewise due to dimethyltryptamine and other tryptamines: the snuffs prepared in the Orinoco basin from seeds of the leguminous *Anadenanthera peregrina*, where it is called *yopo*, and *vilca* or *cébil*, and elaborated in southern South America from the beans of *A. colubrina*; and the drink known in eastern Brazil as *vinho de jurema* and made from roots of the related legume, *Mimosa hostilis*.

The strange but only recently discovered snuff of the central Amazon, *rapé dos indios*, comes apparently from the fruit of the moraceous tree *Maquira sclerophylla*. Thorough ethnobotanical studies on this drug are still needed.

Anadenanthera peregrina *in fruit. San Juan, Puerto Rico. Photo: R. E. Schultes.*

The genus *Datura* has been used hallucinogenically from remote times in both hemispheres. The South American species belong to a subgenus, *Brugmansia*, and all six or eight species are trees. Many tribes in most parts of South America have employed these tree-Daturas, but the identity of the species utilized in a given area has often been uncertain. Recent studies have helped to clear up some of the uncertainties, but the discovery that the Indians in the high Andean Valle de Sibundoy in southern Colombia cultivate for ceremonial, medicinal and narcotic use curiously atrophied clones or races, especially of *Datura candida*, has greatly complicated our botanical and ethnological understanding of this solanaceous genus. The atrophied condition brings about not only morphologically monstrous "varieties" — so distinct that they have precise Indian names — but, according to the native practitioners, they have different biological effects, indicating, of course, that the atrophied conditions may have affected the chemical constituency as well as the morphology. The basic chemical make-up of the genus, with its tropane alkaloids, is well known; but little or nothing is understood about the chemistry of these atrophied clones. Nor do we know what has caused the atrophied conditions of these trees.

In this same mountain valley of Sibundoy, the Indians cultivate a solanaceous tree which has recently been described as a new genus: *Methysticodendron Amesianum.* Obviously closely allied to *Datura*, it may represent possibly a very extreme instance of the atrophied state so common in *Datura* in the region. But if this be so, then we are at a loss as to which species of *Datura* to assign it. The natives prize it as an especially potent hallucinogen and designate it by vernacular names pointing out its strength: *culebra-borrachero* or *mitskway borrachero.* Its chemistry, basally that of a tree-datura, differs from *Datura candida* in relative proportions of the several alkaloids present.

Several other South American solanaceous plants deserve attention as recently discovered or recently researched hallucinogens. The Chilean endemic *Latua pubiflora*, reported in 1858 as *árbol de los brujos*, a powerful poison employed by Mapuche Indians to cause permanent insanity, has been thoroughly studied, from a botanical, ethnobotanical and chemical point of view, only during the last three or four years. It is only six or seven years ago that *Brunfelsia* was found to be employed in the Amazon as an hallucinogen. And the hallucinogenic status of *Iochroma* in the Colombian Andes, open to doubt during the past dozen years, is now more or less settled.

Even with such long known and relatively well understood hallucinogens as the malpighiaceous species called ayahuasca, caapi or yajé — even here there are exciting new discoveries. In 1948, *Tetrapteris methystica* was found to be the source of an hallucinogenic drink in Amazonian Brazil, and *T. mucronata* is indicated by the Karaparaná Indians of the Río Apaporis in Colombia as a source of the narcotic caapi. It is mainly, however, in the study of admixtures to the *Banisteriopsis* drinks that new and fascinating discoveries are being made. For many years, ethnobotanists have known that certain Indians in the

westernmost Amazon add to the ayahuasca, caapi or yajé drink made from the bark of either *Banisteriopsis Caapi* or *B. inebrians* the leaves of oco-yajé or *B. Rusbyana* to lengthen or strengthen the effects of the beverage. Only recently has it been ascertained that *B. Rusbyana* contains dimethyltryptamine, not the β-carboline alkaloids present in the other two species. The leaves of several species of the rubiaceous genus *Psychotria*, especially *P. viridis*, are similarly used on occasion as additives for the same purpose. Chemists have also found dimethyltryptamine in these species of *Psychotria*. This represents the first known occurrence of tryptamines in either the Malpighiaceae or the Rubiaceae. Some of the other plant additives may likewise yield interesting organic compounds when they are analyzed.

Mescaline, the phenylethylamine in peyote responsible for the visual hallucinations, has turned up in the columnar South American cactus *Trichocereus Pachanoi*, basis of the psychotomimetic drink called *cimora* and employed in Ecuador and Peru. A recent addition to the growing list of hallucinogens, this cactus-drink is employed as a sacred "medicine" in magic curing rituals.

There are other narcotics or hallucinogens that bear further ethnobotanical and phytochemical examination: *Lobelia Tupa*, known in the southern Andes as *tabaco del diablo* or *tupa*, is apparently smoked in Chile for its intoxicating effects. Little is known about *Desfontainia spinosa* var. *Hookerii* and the rare endemic *Gomortega Keule*, both used in Chile as narcotics. The well recognized poison *Coriaria thymifolia* has recently been reported as a narcotic in Ecuador where natives sometimes eat the fruit to induce a sense of flight; nothing definitive is known of the active principle. The same may be said for the fruits of several species of *Pernettya* employed in Ecuador and Bolivia.

Waiká Indians sorting leaves of Justicia pectoralis *var.* stenophylla *preparatory to pulverizing them to add to Virola-resin snuff. Río Tototobí, Territorio de Roraima, Brazil. Photo: R. E. Schultes.*

III.

It is not only in the realm of the psychoactive plants that hope for potential new medicinal agents may reside. Recent ethnobotanical field work has uncovered a large number of highly interesting uses of plants in tropical America as physically active medicines or as various kinds of poisons. These plants all deserve study. They represent a range of great diversity in use and effects. Many of them belong to families from which active constituents have rarely if ever been isolated. Consequently, their phytochemical investigation would be, even if only from the academic point of view, illuminating and worthy of attention.

Recent research has disclosed several new or rarely employed kinds of arrow poisons. One hundred and fifty years ago, the German plant-explorer von Martius reported that Indians in the western Amazon of Brazil and Colombia prepared a curare from a small annonaceous tree, *Unonopsis veneficiorum.* Although it is one of the rare curare-plants of the Amazon, this same basic ingredient has recently been discovered in use amongst the Kofán Indians of Ecuador. A wholly new kind of curare amongst the Kofáns is elaborated from the lauraceous *Ocotea venenosa.* The plant contains bisbenzylquinolinic alkaloids. One of the chemical mysteries still to be solved is the identity of the active curare-constituent in the resin of several species of *Virola.* The same species, mainly *Virola theiodora*, employed amongst the Waikás to prepare their hallucinogenic nyakwana snuff is likewise the source, with no admixtures, of one of their arrow poisons. These same Indians value the roots and fruits of the thymeliaceous *Schoenobiblus peruvianus* to prepare one of their numerous kinds of curare. The flacourtiaceous *Mayna amazonica* is also an ingredient of a Kofán arrow poison. The bark of *Connarus opacus* and *C. Sprucei* have recently been reported as ingredients of Witoto curares on the Río Karaparaná in Amazonian Colombia. Another fascinating and newly reported arrow poison is that which the Taiwanos of the Vaupés of Colombia prepare from the bark of the leguminous *Ormosia macrophylla* together with the bark of a *Strychnos* and of *Vochysia ferruginea* and the stems of an aroid (possibly a species of *Philodendron*).

Interesting new types of fish poisons have also recently come to light in South America. The pulp of the fruit of a species of *Caryocar* crushed and mixed with clay represents a principal piscicidal preparation amongst the Kubeo and other Indians of the Colombian Vaupés. In the same area, two aroids are employed for the same purpose: the Desanos cut and bundle the leaves of *Philodendron crasspedodremum* and allow them to ferment and rot for several days, whereupon they are macerated and cast into still water. Another species of *Philodendron*, still not described, is similarly utilized by the Kuripakos of the Río Guainía except that the leaves and petioles are crushed and used fresh. Nothing is known of the chemical composition of these two aroids. A fascinating new species of the bombacaceous genus *Patinoa* — *P. ichthyotoxica* — represents a rare fish poison of the Tikunas of the region of Leticia on the Río Amazonas. The pulp of the large fruit is dried and kept for use throughout the year: it is simply thrown upon the surface of still inlets or ponds to stupefy fish. The Kofáns of Colombia and Ecuador employ *Schoenobiblus peruvianus*, one of their curare plants, to poison fish. Recent investigation has shown that the Kubeo Indians along the Río Kuduyarí in the Vaupés fish with the leaves of the myrsinaceous *Conomorpha lithophyta*, just as the natives of Dutch Guiana use the leaves of *C. magnoliifolia* to narcotize fish. A most interesting newly discovered fish poison is the root of the acanthaceous shrub *Mendoncia aspera*, valued by the natives of the Río Kananarí in the Vaupés; phytochemically, this genus is wholly unknown.

There are many species of plants in the western Amazon which the Indians avoid as toxic. These poisons warrant study as potentially biodynamic agents for, in some cases, they belong to genera or families from which active principles have never been found. Several cucurbitaceous species of *Gurania* and *Anguria* are considered toxic. A large number of rubiaceous species, especially in *Psychotria*, *Palicourea* and *Duroia*, are believed to have dangerous properties when ingested. The resin that naturally exudes from *Retiniphyllum concolor*, *R. discolor*, *R. speciosum* and *R. truncatum* is said to be poisonous and, because of this characteristic, enters into certain magical rites practiced by the medicine men in the Vaupés. There are many apocynaceous species in this same category of suspected poisons, especially in *Malouetia*, *Himatanthus*, *Tabernaemontana* and *Aspidosperma*; chemical studies of some of these genera bear out the veracity of the native lore. Various members of the Flacourtiaceae — some employed medicinally by the Amazon Indians — are suspect, especially in the genera *Mayna*, *Lunania* and *Ryania*: *Mayna muricida*, for example, has poisonous seeds employed to kill rats, and *M. toxica* is held to be one of the most poisonous plants of the Vaupés forests. *Lunania* *parviflora* is said formerly amongst the Tikunas to have been added to the food to despatch enemies or unwanted visitors. Nothing is yet known of the chemistry of these flacourtiaceous species.

Ethnotoxicological studies in South America have revealed that the Malpighiaceae deserve closer scrutiny as a family with interesting biodynamic constituents. Several species of *Tetrapteris* are either avoided as poisons or are bent to use in folk medicine by Indians of the Colombian Vaupés. *Heteropteris macrostachya* provides the Indians of the Río Apaporis with an infusion made from the leaves and stems for bathing skin covered with what appears to be fungal infection, and the Sionas of the Putumayo value *H. riparia* in the treatment of gonorrhoea. Several tribes assert that *Mascagnia glandulifera* might be employed medicinally but that it is usually avoided because of toxic side effects. The same is true of several species of *Hiraea*, especially *H. apaporiensis* and *H. Schultesii.*

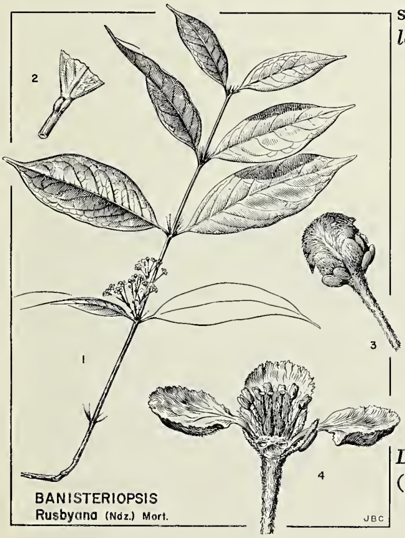
There are many plants in smaller families that enter into the ethnopharmacology of tropical America, and recent work has greatly increased our knowledge in this direction. A few examples of the many must suffice here to indicate the extent and promise for intensified research into the medicinal potential of the tropical floras.

The Kubeos of the Vaupés use an astringent tea of the dried and powdered root of *Aristolochia medicinalis* in treating individuals who suffer from frequent attacks which may be epileptic; the infusion cannot be taken in large doses or too often because of the danger, according to native medicine men, of its causing permanent insanity and muscular paralysis.

There are two plants that are used, apparently with some success, to relieve eye infections such as conjunctivitis which is very common in the Amazonian regions: the yellowish leaves of the bignoniaceous vine *Arrabidea xanthophylla* are made into an infusion by the Tikunas to treat eye infections; the Makunas of the Río Piraparaná cultivated the cucurbitaceous *Cayaponia ophthalmica* for this same use.

An interesting plant, the red saprophyte *Helosis guyannensis* of the Balanophoraceae, provides the Tikuna Indians of the Colombian Amazon with an heamostatic powder said to help congeal blood flowing from deep wounds. Whether or not its apparent effect is due to an active principle or to the mechanical increase in surface due to the fine powder cannot be stated at present. There is also the possibility that this use was sug-

Above: Cultivated vine of Banisteriopsis Caapi. *Río Piraparaná, Vaupés, Colombia. Photo: R. E. Schultes.*



Left: Detail of Banisteriopsis Rusbyana (Ndz.) Mort.

gested to the Indians by the bright scarlet colour of the mushroom-like plant.

Many bitter plants are valued as febrifuges — most of them probably without any positive activity against fevers except possibly to relieve stomach discomfort and nausea that often accompany malarial and other fevers. One of the most widely esteemed is a species of the solanaceous *Brunfelsia*, known in Peru as *chiric-kaspi.* Another species highly valued in the Vaupés region is the bignoniaceous *Martinella obovata*, from the root bark of which a strong infusion, reputedly rather dangerously toxic, is prepared.

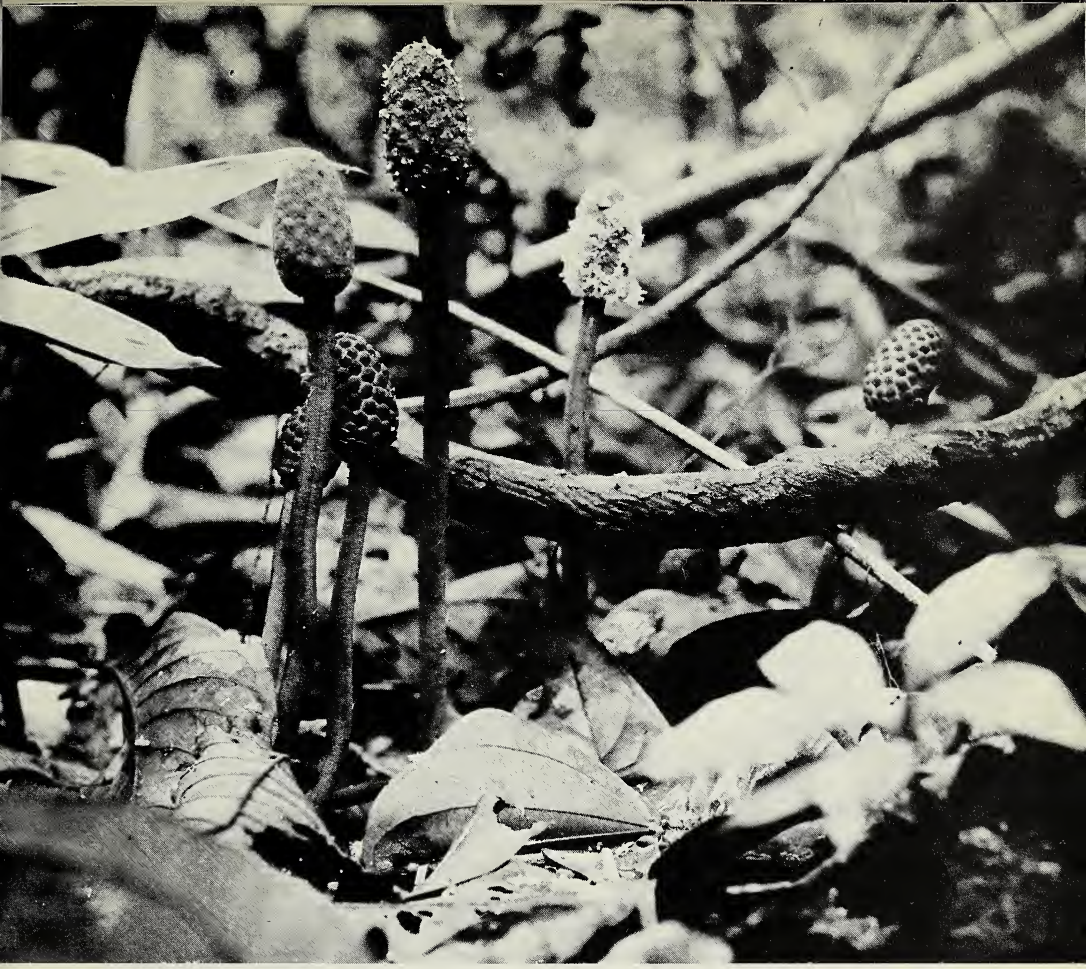
The myristicaceous plants of tropical America are ethnotoxicologically of extreme interest and bear pharmacological investigation. Quite aside from the importance of certain species of *Virola* as hallucinogens, some members of this family appear, at least from native uses, to be psychoactive. *Campsoneura capitellata* is the source of a tea which the Makunas and Barasanas give to warm natives "who go crazy and shake all over"; it is said to help "to calm them down". In Brazil, the resin of *Virola Bicuhyba* is reputedly a "brain stimulant". A surprising variety of myristicaceous species finds use in the western Amazon in the preparation of a wash for fungal or other skin infections or for infected wounds: *Campsoneura debilis, Iryanthera crassifolia, I. longifolia, I. polyneura, I. tricornis, I. Ulei, Virola carinata, V. flexuosa, V. Schultesii* and *V. surinamensis.*

During my many years of botanical exploration in the northwestern Amazon, I encountered three plants used in the belief that they have properties that make them oral contraceptives: *Philodendron dyscarpium, Urospatha antisyleptica* and *Anthurium Tessmannii.* These three plants belong to the Araceae. The first two are employed by a number of tribes in the Vaupés; the third by the Tikunas in the Colombian Amazonas. Corroborative pharmacological tests have not been carried out nor is anything known about their chemical constitution.

IV.

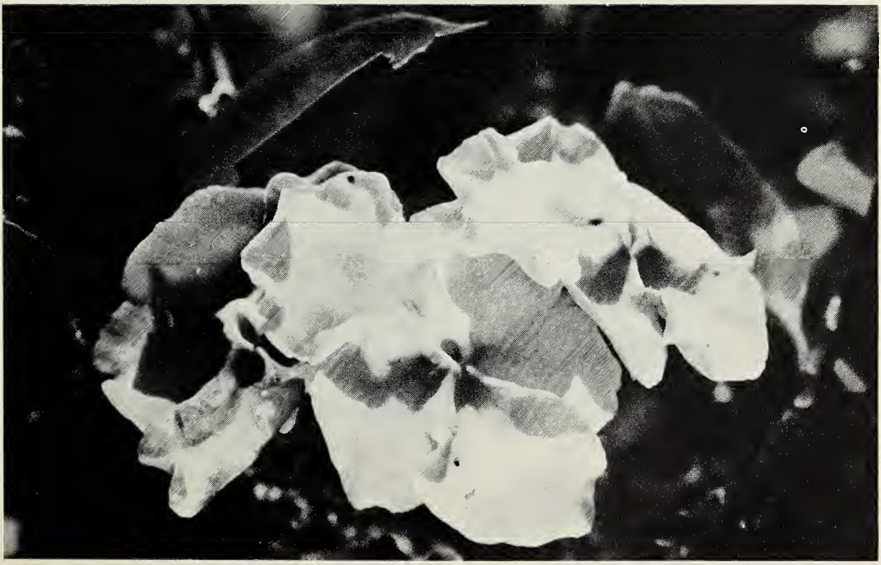
What of the future? How much longer will this fund of ethnopharmacological lore be available for us to tap in our search for new medicinal plants?

The future looks dim. What we euphemistically call civilization is on the march everywhere. It has long been on the march, but its pace is now accelerated. Wars, easier tourism, the construction willy-nilly of roads, increased commercial and missionary activity are penetrating vast areas, especially in tropical



Above: Helosis guyannensis. *Near Leticia, Amazonas, Colombia. Photo: R. E. Schultes.*

Below: Flowers of Brunfelsia *sp. Río Guamüés, Comisaría del Putumayo, Colombia. Photo: T. Plowman.*



America — areas hitherto more or less virgin and left to primitive societies, if indeed they were inhabited at all. Our political leaders equate "progress" with destruction of natural resources. The forest is, to many of them, an obstacle to be removed.

What concerns us primarily as ethnobotanists is the progressive divorcement of primitive peoples to a greater or lesser degree from dependence upon their immediate ambient vegetation. Even if peoples are not exterminated or eliminated by racial and cultural absorption, the arrival and cheap availability of the aspirin pill and quinine tablet, for example, seems often to start an astonishing disintegration of native medicinal lore. The rapidity of this disintegraton is frightening. That the aspirin may be more efficient than native herbal remedies and magic is not ours to consider here. What does interest us — and worry us — is the almost certain loss in the next half century of the greater part of America's nature herbal lore. Our search amongst the Plant Kingdom's half million species for new medicines will then have lost a most valuable and promising field of exploration.

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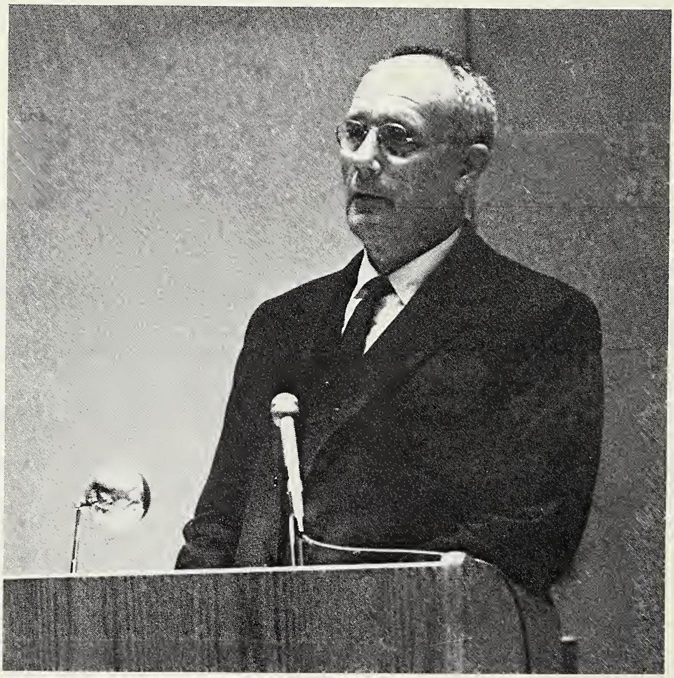

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Plants and Gardens of South Africa

South Africa has contributed significantly to world horticulture by providing such plants as Gladiolus, Kniphofia, Pelargonium, Freesia, Tritonia, Sparaxis, Gerbera, Strelitzia, Plumbago, Tecomaria, Agapanthus, Streptocarpus, Nemesia and a host of others. Many are grown as natural species in botanic gardens, public parks and private gardens all over the world, while others, through the work of plant breeders, are now quite different from the species from which they were originally developed. Modern garden forms of Gladiolus and Pelargonium — the latter usually referred to as Geranium — are typical of the plant breeders' skill.

South Africa's contribution to world botany and horticulture started centuries ago. It is still contributing and will continue to do so very largely through the activities of the National Botanic Gardens of South Africa. Every year native species hitherto never cultivated by man are introduced into the Gardens, propagated and increased until sufficient seed is produced to make it available free of charge to botanic gardens, other scientific institutions and members of the Botanical Society of South Africa in all countries of the world. In 1953 seeds of 550 species were offered and this year the number has grown to about 1,500.

Before I expand my theme let me briefly list some of the contributions which the National Botanic Gardens of South Africa have made to botanical science.

1. They are field laboratories for the study of South African plants.
2. At Kirstenbosch and the Natal Botanic Garden at Pietermaritzburg they provide open air classrooms for instruction in nature study by full-time qualified teachers to classes of school children every school-day of the year.
3. Class material is supplied to universities, training colleges and schools.
4. Plant material for research purposes is sent on request not only to workers in South Africa but throughout the world.

There is no end to the type of research for which it is required. Herbarium and live specimens are supplied for taxonomic studies on South Africa's native flora. Material is also provided for chemical, cytogenetic, morphological, anatomical, physiological, pathological and medical investigations.

5. The National Botanic Gardens of South Africa publishes the Journal of South African Botany which includes contributions embodying the results of botanical research on any of the various branches of the science which have a bearing on the flora of South Africa.
6. Many species rare or even exterminated in their natural habitats are cultivated and thus preserved in botanic gardens. A threatened species such as *Serruria florida*, the Blushing Bride, is a good example. In the Franschhoek Mountains (the only place where it is known to occur naturally), its future existence is very precarious. Soon after Kirstenbosch was established seed was collected and sown. Now we have hundreds or thousands of plants and from these seed is distributed to all parts of the world. The extermination of this species has therefore been prevented.
7. Although the long-term aim is to grow all the South African species in our botanic gardens, special attention is paid to the large scale propagation of the more showy and ornamental types to encourage municipal parks and home gardeners to take a greater interest in South Africa's natural flora and to use it in garden layouts.
8. Apart from their scientific and educational value, botanic gardens provide areas for recreation and relaxation. This aspect is of tremendous importance and will become more so in the future. If man is to advance in a world of hustle, bustle, cut-throat competition, noise, strife and uncertainty, he needs, and his body and spirit demand, peace, beauty and quietness. These he can find in a botanic garden.
9. These contributions collectively have been responsible in educating and encouraging the people of South Africa to take a greater practical and enlightened interest in the study, cultivation and conservation of the natural flora of their country.

I trust that I have made it clear that botanic gardens are of value to science and to man. The need now is to ensure that all or as many as possible of the vast number of species native to South Africa should be cultivated in botanic gardens. The

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garden at Kirstenbosch was established in 1913 with this as one of its main objects, and we must admit that it has achieved considerable success in that about a quarter of the nearly 20,000 species native to South Africa are at present grown there. However, experiencing a Mediterranean type of climate with heavy winter rain and summer drought it is not suitable for many of the plants of the semi-arid regions, the Highveld, the Lowveld or the sub-tropical coastal areas. The Karoo Botanic Garden was established at Worcester for the flora of the drier parts of South Africa and for succulent plants generally, some of which are not confined to the semi-deserts. Worcester, incidentally, has an annual rainfall of approximately 130 mm. (5 ins.) compared with 1,500 (60 ins.) at Kirstenbosch. This development helped considerably to increase the number of South African species in cultivation.

Some time later the Botanical Research Institute created its Pretoria National Botanic Garden to function largely as an adjunct to the National Herbarium — a living herbarium we might call it. Under the control of the National Botanic Gardens of South Africa there are now 7 gardens; in the South Western Cape, Kirstenbosch at Cape Town and the Karoo Botanic Garden at Worcester have already been mentioned. In the Harold Porter Botanic Garden at Betty's Bay, situated in the richest floral area of South Africa, the Caledon Division, only plants indigenous to the winter rainfall region are cultivated. The Tinie Versfeld Wild Flower Reserve in the Darling area, as yet undeveloped to any extent, is concerned with the natural flora of the Sandveld and Swartland region of the Cape, whereas the Edith Stephens Cape Flats Wild Flower Reserve is devoted to the cultivation and preservation of the fast disappearing vegetation native to the Cape Flats.

It was not until 1967 that the National Botanic Gardens of South Africa extended its activities outside the Cape Province. This was the first phase of a programme of establishing botanic gardens in the main ecological regions of South Africa. The purpose of this programme is twofold; firstly to provide sites where eventually the entire South African flora can be culti-

Above left: Babiana villosa
right: Gladiolus carneus

Below left: Gladiolus recurvus
right: Streptocarpus rexii
All from Curtis's Botanical Magazine. *Vol. 16. London, 1803.*
Except Streptocarpus rexii. *From* The Botanical Register. *Vol. 14. London, 1828.*

vated, and secondly to make botanic gardens accessible to as many people in the country as possible.

Each Garden has a very special, definite and specific policy to cater for the natural flora of a selected ecological, geographic or climatic area.

The Orange Free State Botanic Garden near Bloemfontein, as its name implies, is concerned only with the indigenous vegetation of the Orange Free State, whereas the Drakensberg and Eastern Free State Botanic Garden at Harrismith was established to accommodate the species of the entire Drakensberg range occurring more than 1,500 mm. (5,000 feet) above sea level and of the Eastern Orange Free State within a radius of 160 km. (100 miles) of Harrismith. The last two additions were the Lowveld Botanic Garden at Nelspruit in the Eastern Transvaal and the Natal Botanic Garden in Pietermaritzburg. In the former case the broad grouping by Acocks of Tropical Bush and Savannah Types forms the basis of selecting the ecological region and in the latter case the Garden serves the Province of Natal.

This programme of the expansion of the National Botanic Gardens of South Africa has been carefully considered and it is felt that with the establishment of additional branch Gardens for the Eastern Cape, Natal sub-tropical coast, the Highveld and possibly South West Africa, the main geographical, ecological, climatic and population regions of South Africa will be adequately covered.

To provide the maximum contribution to science it is considered that the various Botanic Gardens should, as far as possible, be situated near large educational centres or near areas of dense population.

The eagerness and horticultural knowledge with which people are growing Proteas, Heaths and other plants are largely due to the example set by Kirstenbosch over a long period of time. Gardeners are now anxious to cultivate other types of native plants throughout South Africa. Proteas and Heaths may be very popular but they will not thrive everywhere. Since starting the Regional Botanic Gardens outside the Western Cape, many local species never cultivated before have been collected and grown in these Gardens.

I make bold to predict that within the next few years such species will be grown and cherished in many home gardens as a result of the public being able to learn their names and to observe their horticultural potential in the Botanic Gardens. It is a natural and obvious consequence. These species were probably evolved locally, they are adapted to the local climatic and soil conditions and with the help of man by watering to relieve drought and weeding to remove competition they will assume their rightful place as most desirable and "easy" horticultural subjects. What is more, seed will be made available to scientific institutions and members of the Botanical Society of South Africa free of charge.

When all the gardens which I have mentioned have been established and developed, a complex will have been created which will be quite unique. I know of no other country in the world which is developing its botanic gardens on a similar principle and for this reason we can be justly proud of our endeavor to contribute to science and the advancement of man.

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Director, National Botanic Gardens of South Africa
and Harold Pearson Professor of Botany,
University of Cape Town

The Hysteria Against the Case

Recently Stanford physicist Dr. Sidney Liebes, Jr. proposed an interesting exhibit for the next Earth Day — a graphic display to illustrate the course of evolution. He suggested [1] that the display be 5001 feet long, just under one mile. The starting point would be labelled 5000 feet from the present, representing the formation of the Earth, 5 billion years in the past. Each foot of the display would then represent one million years. The first 4000 feet would represent the eons when no multicellular organisms existed. The age of the dinosaurs would stretch from 200 to 60 feet from the present. Within 6 feet the first "men" would appear. The agricultural revolution would occur about one-tenth of an inch from the present; the year 2000 would be only five ten-thousandths of an inch in the future.

To quote Dr. Liebes, "A human population curve might be plotted, scaled at one vertical foot per 100 million human beings. One million years ago (one foot into the past) the population curve would be one-hundredth of an inch high. Ten thousand years ago (0.1 inch into the past) the curve would be half an inch high. At the time of Christ, 0.02 inch into the past, it would be two feet high. In April 1971 it would be 37 feet high and climbing vertically at a rate of some 37 feet for each horizontal one-half of a thousandth of an inch."

Just one more way to dramatize the unique situation in which *Homo sapiens* finds itself? Perhaps. But I think it also contains a clue to a problem which has concerned my colleagues and me a great deal lately. Attempts to focus public attention on the seriousness of the environmental crisis has aroused a heavy "backlash" from certain politicians, labor unions, industries, a wide variety of scientists and technologists employed by government and industry. Their motives may be less than noble but at least they are understandable. Interestingly enough, however, some of the most ill-informed and vitupera-

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tive opposition has originated among those who have no clear pecuniary motive in promoting environmental deterioration. In particular, biochemists,[2] physicists,[3] demographers,[4] chemists,[5] and economists [6] have stepped forward to condemn ecologists for "exaggerating" mankind's peril. The whole backlash is typified by a blithering unsigned editorial in *Nature*, entitled "The Case Against Hysteria".[7]

It would be simple to write off their attacks as being simply a function of jealousy at the attention suddenly showered on ecologists, since this is obviously involved in several cases. But I cannot believe that otherwise competent scientists would publish pronouncements in areas so clearly outside their competence *unless they actually felt that they understood what they were writing about.* Few people are anxious to appear foolish in print. The hypothesis that these colleagues don't realize that they are out of their depth is further supported by a characteristic of their writings: rarely is there any sign that their statements have been reviewed prior to publication by anyone even remotely familiar with the technical literature of ecology (which I define broadly here to include evolutionary biology, biosystematics, and so forth).

Which brings me back to the Liebes display. Dr. Liebes clearly possesses something universally absent from the spokesmen of what I will call the *scientific backlash.* He has an evolutionary perspective. Putting man's present behavior into the context of evolutionary time in itself should be enough to bring most of these spokesmen to a reconsideration of their views. Can they really view with equanimity a human population explosion occupying only one-tenth of an inch on a 4000 foot scale of life? Can they fail to appreciate the significance of the rise, in a mere instant of evolutionary time, of just one among perhaps 5 million animal species to a position of dominance in the biosphere? Can they, for instance, remain undisturbed while that species exhausts the Earth's entire store of liquid petroleum in less than one thousandth of an inch?

The answer is, sadly, that they probably can, and we evolutionary biologists must share a large part of the blame. We have consistently failed to develop a broad evolutionary perspective among scientists in general; indeed among biologists in general. This has permitted many scientists to view the population-environment crisis as a phenomenon that sprang *de novo* from the ruins of World War II.[8] This narrow perspective helps generate the belief that rather minor changes in human behavior can get us through the crisis. Install a smog control device here, a breeder reactor there, farm the Amazon Basin, pass out contraceptives — but never promote a revolutionary change in the behavior of an entire species.

Along with this lack of perspective three sources of misunderstanding seem to be at the root of most of the scientific backlash. The first is a confusion of pollution with environmental deterioration. This is closely linked with ignorance of the critical role of agriculture in the latter. The second is a series of misapprehensions about the so-called "demographic transition". And, finally, there is a lack of grasp of the consequences of exponential growth itself.

Environmental Deterioration

The confusion between pollution and environmental deterioration is perhaps best illustrated by the backlasher's "London Smog Defense". The argument is made that ecological disaster can be avoided by the kind of steps which have made the air in London less opaque since the great smog disaster of 1952. John Maddox makes this point.[9] He points to lower levels of particulates and sulfur dioxide in some urban environments in 1969 and 1970 than were present in 1962 and 1959. He then concludes: "what these and other statistics imply is that pollution and other assaults on the natural environment are not nearly as novel as those who have recently discovered them pretend." Needless to say, ecologists are only too aware, as Maddox apparently is not, that serious environmental deterioration dates at least back to the agricultural revolution.[10]

Furthermore, the relatively novel elements of air pollution are neither particulates nor sulfur dioxide but nitrogen oxides and hydrocarbons (the sources of photochemical smog), radioactive materials and a wide variety of molecules synthesized by man which are truly novel in the sense that organisms have no previous evolutionary experience with them. And, from the point of view of global ecology, urban pollution may not be as important as the general dust load, especially from agriculture, which may ultimately have a serious effect on climate if population growth continues. But, more important, air pollution is by its nature the most readily reversed of pollution problems. In a sense we must continue to expend energy to keep the pollution airborne. If we stop pouring wastes into the atmosphere, most air pollution will settle out and convert itself automatically into soil and water pollution. From the point of view of man's long term tenure on Earth, air pollution may prove to be a trivial matter compared to, say, the reduction of organic diversity — unless a catastrophic climatic change or reduction in the ozone screen is triggered.[11]

What the producers of the scientific backlash fail to grasp is that man depends on natural ecosystems for the operation of the chemical cycles which support our food production, for the control of most potential pests of our crops, for the maintenance of the quality of the atmosphere, and for the storage of the genetic information from which all new strains of crops, biological pest controls, and antibiotics (among other indispensables) must come. We depend on those systems for virtually the entire commercial fisheries yield — the source of a substantial proportion of mankind's desperately needed supply of high quality protein. And one of the major factors in the stability and thus continued functioning of those systems is their complexity.

Unfortunately a vast spectrum of human activities, rapidly increasing in scale, has led directly and indirectly to the reduction in size or extinction of populations of many organisms, and to the extinction of some species. The loss of diversity has reduced the complexity of natural ecosystems and thus also reduced their stability. More and more energy is being diverted from the maintenance of complex networks involving millions of other kinds of organisms to the exclusive support of *Homo sapiens*. A side effect of this is a general repatterning of our life support systems so that, increasingly, energy is flowing through the simple food webs of decay rather than through the complex and relatively stable herbivore-carnivore webs. As George Woodwell [12] put it, "the longterm trend of evolution toward building complex, integral, stable ecosystems is being reversed". Simultaneously, man also has been further simplifying the artificial ecosystems which he has created in the course of practicing agriculture. In addition, all current trends indicate a pattern of rapidly accelerating simplification. The consequences of this can only be predicted in a general way — a lowering of the carrying capacity of the Earth for human life.

Agriculture itself is central to the problem of ecosystem simplification. As the human population has grown, more and more land has been brought under cultivation. Generally this has meant the replacement of relatively complex and stable forest and grassland ecosystems with stands of one or a few kinds of plants, or the replacing of a balanced community of herbivores and predators with herds of domestic animals. Very often the instability of these systems has resulted in their collapse. Sometimes the collapse was followed by at least partial restoration of diversity. For instance, tropical forests partially reclaimed overworked milpa systems when the classic Maya civilization disappeared. Sometimes the complexity is not restored, as when faulty irrigation resulted in the desertification of the Tigris and Euphrates valleys.

But, in any case, man tends to pay a price when he is not successful at maintaining the stability of his simple ecosystems. Consider the results of an early "Green Revolution", the introduction of the potato to Ireland. The productivity of the potato provided the basis for an increase in the Irish population from about 3 million to 8 million people.[13] Unfortunately, as has frequently occurred, expansion of food supplies did not result in a general rise in the standard of living. Population increased along with food supply, and improvement in per capita supplies was limited. Then in 1845–48 the inevitable happened: the unstable potato ecosystem collapsed. A fungal blight invaded the fields and destroyed most of the crop, producing one of history's great disasters — the Irish Potato Famine. In a four year period about 1.5 million Irish men, women, and children starved to death. An additional million or so were forced to emigrate, and millions of others underwent great suffering and deprivation. The entire horror could be traced to the inherent instability of a simple ecosystem.[14]

Man is forced to pour large amounts of energy into modern high-yield agricultural ecosystems in order to stabilize them. This energy is provided mostly as fossil fuels used to manufacture and transport pesticides and fertilizers, to construct and operate irrigation systems, and to cultivate the crops. The productivity of modern agricultural systems is, of course, based on the success of plant breeders at producing genetic strains which, given the proper "inputs" to the agricultural system, produce very high yields per acre. Under the related pressures of economics and population growth, a relatively few high-yield strains of crops are now rapidly replacing a rich diversity of more traditional strains. This is resulting in a further simplification of ecosystems, through the loss of genetic diversity in crops.[15] Should enough of that diversity be lost, man could well be out of business of high-yield agriculture forever. There is, of course, no such thing as a strain of plants permanently "resistant" to all the organisms which attack it. Plants, like other organisms, are involved in a continual "coevolutionary race" [16] with their parasites and predators. Unless the genetic variability necessary for natural selection to occur is maintained, new defenses cannot be evolved to meet new attacks. The race is lost and extinction results.

This rather important point is lost on those ignorant of evolutionary ecology. For instance, Maddox writes,[17] "In any case, damaging though plant diseases can be to harvests, there is no more reason to fear that they need go uncontrolled than there is to fear that infectious diseases that sweep the human population like medieval plagues will again be a hazard to human survival." If Maddox understood more of ecology, genetics, and epidemiology, he would know that there is ample reason to fear both.

The Demographic Transition

In fairness to those creating the scientific backlash it must be noted that most realize that human population growth must stop eventually. And, of course, the demographers in the group know very well how far off that "eventually" is likely to be if a halt is to be achieved by reduction in birth rates rather than a rise in death rates (their complacency about the current state of affairs seems rooted purely in their misunderstanding of the physical and biological world). But a major source of misapprehension among technologists relates to ideas about automatic (and relatively rapid) control of population. A typical view is that expressed by that most un-ecological of gentlemen, Buckminster Fuller, in a poem he sent to Senator Edmund Muskie: [18]

> "As world industrialization will be completed
> By twentieth-century's end
> The ever-diminishing birth rate
> Of the industrial countries
> Will bring about world population stabilization
> By 2000 A.D."

Skipping the small point that world industrialization by the year 2000 is clearly not possible (indeed it may never be), it must be pointed out that even if reproduction around the world dropped to the replacement level *now*, population growth will continue until nearly the middle of the next century! Although few of the other backlashers can be accused of making statements quite that absurd, some of them have come pretty close. Maddox writes,[19] ". . . in any case there are already signs that the most rapidly growing populations in the world will in the next few decades be held in check by natural social forces — not just the machinery of contraception — which have in the past century given Western Europe and North America a measure of demographic stability." His general confusion about elementary demography is further illuminated by the incredible statement,[20] "Just what is meant by demographic stability? The slogan 'Zero Population Growth' is not much help, as can be told from what is now happening in Western Europe. The number of births each year is for practical purposes the same, but the population continues to grow." Maddox follows this with a discussion which shows that he does not know the difference between a stable population (one with a stable age distribution), a stationary population (one where crude birth rates and death rates are in balance, producing ZPG), and a population with a net reproductive rate (NRR) equal to one (where each generation of women is just replacing itself). He also makes the most elementary error of discussion reductions in the numbers of births without simultaneously analyzing trends in death rates, and even then carefully selects his data. Thus from his table showing "Decreasing numbers of births in selected countries", a naive reader might assume that the population explosion in Africa was about over, when in fact anticipated declines in death rates there may result in annual growth rates in the vicinity of 4% in the not too distant future.

Maddox's discussion is capped by the statement [21] "Although the demographic transition has only just begun in large parts of the developing world, there is every reason to expect that it will produce demographic stability entirely comparable with that which now exists in Western Europe and elsewhere in the industrialized world." If it only were that simple! A casual look at the statistics [22] will reveal the most fundamental flaw in this thesis, as he could have found out. *Even after the completion of the demographic transition, the developed countries still have high growth rates.* The reduction in birth rates associated with the demographic transition was not adequate to compensate for the even more dramatic fall in death rates that preceded it. In the industrial areas of the world the transition was essentially over by 1940.[23] A quarter of a century later, birth rates in Europe, North America, the USSR, Australia, New Zealand and Japan were still, on the average, almost double the death rates. This is, to varying degrees, a result of the age composition of the population as well as of excess fertility. Nonetheless an examination of net reproductive rates [24] from the 1920s to today in the industrialized nations gives little reason to assume there is an automatic process of population regulation leading to stationary populations. Indeed it seems at least as likely, assuming death rates did not rise, that industrial nations could fluctuate over the long term at growth rates of about 0.5–1.0% annually, doubling their populations every century or so.

Let's examine, however, what *would* happen if demographic transitions started immediately in underdeveloped countries (UDCs) and followed a pattern similar to that experienced by the developed countries (DCs) in the past. It would be perhaps eighty years before one could expect growth rates in underdeveloped countries to be in the relatively low range now found in developed countries.[25] To see that such a demographic transition in the UDCs cannot stop population growth without a substantial delay, it is only necessary to examine a much more optimistic projection. Demographer Nathan Keyfitz has recently calculated the possible results of a population control miracle (which we might call a "super demographic transition").[26] He calculated, in essence, what would happen if family size dropped precipitously in UDCs so that by around the year 2000 reproduction had reached replacement level. If that should occur (and no competent demographer thinks there is the remotest possibility of it occurring) the size of the population of a typical UDC would be 2.5 times its present size when it eventually stopped growing.[27] That means, for instance, that the population of India would be some 1.4 *billion* people, that of China perhaps 1.7 *billion*, Brazil's 240 million, Indonesia's 310 million, and so on. *Note that these are estimates based on wildly optimistic assumptions about population control.* Since most underdeveloped nations are in the tropics, one need only mesh this information on the momentum of population growth with some knowledge of the problems of agriculture in the tropics [28] to see that the invocation of the demographic transition as a "cure" is a tragic mistake.

Maddox is not alone in clinging to the demographic-transition-is-a-panacea view. Indeed he may have picked it up from Barry Commoner's book, *The Closing Circle*, which he strongly attacks. If so, it is poetic justice, since Commoner's treatment of the demographic transition is a low point in a volume not outstanding in its scientific competence. Commoner not only misinterprets the demographic transition, he also perpetuates the myth that population control soon can be achieved by, in part, dropping infant mortality rates. Laudable as the goal of reducing such rates is on grounds of compassion, it would in many cases result in temporarily rising growth rates, since the projected declines in birth rate will not compensate for the lowered death rates.[29] Moreover, there is virtually no evidence that depressing infant mortality rates anywhere would result in lower birth rates until at least a generation had passed.

In addition it is not at all clear that UDCs would undergo a classic demographic transition, even if they were industrialized. The social and economic conditions are so different in those countries today in comparison to those in the now developed countries in the last century that prediction is difficult.

Exponential Growth

Finally, there is the problem the backlashers have in coming to grips with exponential growth. They do not comprehend that in a sense the last million years or so of cumulative human population growth will, barring disaster, be duplicated in the next 35 years. When something is growing (or shrinking) exponentially, a constant percentage of its size at the beginning of each successive period is added (subtracted) during that period. When the exponential rate does not change, the growth can be characterized by the doubling time — the period required for the original quantity to double. Thus the human population, now growing at a rate of 2% a year, will have a doubling time of 35 years if that rate remains constant.

This bit of simple arithmetic leads to an important way of looking at various kinds of limits. Suppose that the human population continues to grow at a constant rate of 2% per annum, doubling every 35 years. Suppose also that somewhere there is a limit to this growth, determined by the carrying capacity of the Earth. That is, assume that there is some population size, which if reached in the future will overload the system and result in a catastrophic population crash. Such an assumption should be acceptable to most backlashers, who are willing to admit that population cannot grow forever. An important conclusion follows from these two assumptions. Whatever the overload size is, the population will be only one-half that size a mere 35 years before disaster strikes.

Exponential growth progresses towards limits at an accelerating rate: a long history of growth does not necessarily imply a long future. It is no surprise that many environmental problems are perceived by the naive as having materialized *de novo* in the past few decades. Many of these problems are simply manifestations of exponential growth processes interacting with a series of thresholds. Similarly, recent awareness of impending resource depletion in part reflects exponential shrink-ages of reserves in response to exponential increases in demand. For instance, mankind now gathers somewhat over 60 million metric tons of fishes annually [30] from the "limitless" resources of the sea. Many fisheries biologists feel that, in the absence of overfishing and ecocatastrophe, the maximum sustainable yield would be some 100 million metric tons.[31] If that is the case and the human population continues to grow exponentially, per capita yields *must* decline around the year 2000 because another doubling of total catch will not be possible. Suppose, on the other hand, that a yield of 200 million metric tons can be sustained. If exponential population growth persists the decline is postponed a mere 35 years to around 2035. But, of course, it now appears that overfishing and oceanic pollution may prevent us even from approaching the lower figure.

The situation is especially frightening when one considers that recent estimates of the increase of environmental impact (or "ecological demand") are in the vicinity of 5% per annum [32] giving a doubling time of 14 years. If these estimates are correct, the ecosystems of the Earth will not have been stressed to half of their limit until only 14 years before they collapse. In an oversimplified view, if the symptoms of ecosystem malfunctioning of the first Earth Day in 1970 indicated that the systems were absorbing one-half of the impact they were capable of absorbing, then disaster is scheduled for 1984. If one wishes to make an ultra-optimistic assumption, that the systems can absorb more than 30 times as much punishment as they were receiving in 1970, then the ultimate disaster is deferred until 2040 — should ecological demand continue to grow at 5% per annum.

The seriousness of exponentially approaching limits is, of course, exacerbated by the momentum inherent in many current trends. The delays built into any reasonable program to halt population growth have already been mentioned. And apart from those intrinsic in the bottom-heavy age structure of rapidly growing populations, there are, of course, those resulting simply from the time lag which seems inevitably involved in public acceptance of new behavior patterns. The experience of the last few years also shows clearly that sounding of the ecological warning will not be followed by instant and drastic action to avert disaster (remember, a system stressed to only one-half the breaking point may seem in no danger whatever). Furthermore many ecological insults, such as persistent poisons, may do their greatest damage some time after they are released. And worse, many of their consequences may be irreversible. In short, when a system is careening towards ecological oblivion, it may not be possible to turn aside at the last minute, and the point of no return may be passed without being detected.

Conclusion

Whatever time is left, it is clear that our chances of survival will be enhanced if the effects of the scientific backlash can be minimized. On the bright side, numerous natural and social scientists untrained in ecology have educated themselves about the environmental situation and are working with ecologists in attempts to find solutions. The groundswell of informed opinion is impressive — the *SCEP* report, the report of the *Workshop on Global Ecological Problems*, the work of the Meadows' group summarized in *The Limits to Growth*, and the report of the Commission on Population and the American Future all indicate growing organized movement in the right direction.

Furthermore we have one substantial resource which remains largely untapped. I am referring to the thousands of biologists who have the training to understand the current situation. Many individual ecologists, evolutionists, systematists, and so on have been heavily involved in the fight for survival, but they do not make themselves felt *en masse*. All of us have seen numerous examples of pseudo-expertise, some even more blatant than Maddox's masquerade. Consider for a moment the reaction of the American Medical Association to quacks — political pressure, successful lobbying for laws to restrict practice, and so on. But the number of quacks claiming to be ecologists is now myriad, and hardly a murmur is raised. It is high time that population biologists began to speak out as a group, through their professional organizations. It will take time, energy, money, and the recognition that some "unscientific" activities such as public relations are required if a world in which scientific research can be pursued is to persist.

On its one hundredth anniversary it seems unlikely that the Arnold Arboretum will be around to host a bicentennial celebration. It is ironic that those most interested in its well-being are among those most capable of brightening its future. Or perhaps I should say that it is hopeful. Agriculture is moving to the center of the world stage, and plant scientists must move with it. Plant ecologists, geographers, taxonomists, evolutionists, must play key roles in the development of high yield agricultural systems which do not endanger the carrying capacity of the planet. Biologists must strive to find ways to inform the public about the problems of producing food and how these problems relate to the functions of the Earth's ecosystems. I can testify from wide personal experience that many if not most Americans now think their food materializes by magic in supermarkets. If that is still true a decade or so from now it means that institutions like the Arnold Arboretum will have failed when mankind needed them most.

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Notes

1. *Stanford Daily*, April 12, 1972.
2. Philip Handler, President of the National Academy of Sciences,

a highly competent biochemist, has unfortunately attempted to minimize environmental problems. The quality of his thought on ecological matters can be gleaned from his statement (*Science*, vol. 171, p. 148) "The predicted death or blinding by parathion of dozens of Americans last summer must rest on the consciences of every car owner whose bumper sticker urged a total ban on DDT." It is a pity he has not bothered to learn a little more ecology so that he could evaluate pesticide risks not associated with acute toxicity; men with his intelligence are badly needed on the side of survival.

3. Physicist John Maddox has performed the service of presenting in a single book, *The Doomsday Syndrome* (Macmillan & Co., Ltd., London, 1972), numerous examples of the ignorance, sloppy thinking, selected data and outright error which characterizes the worst of the backlash.
4. Demographer Philip M. Hauser perhaps characterizes the best of the backlash among demographers. A distinguished scientist who has been in the forefront of warning about various consequences of the population explosion, he got beyond his area of recognized expertise when he decided that environmental problems were not as serious as ecologists thought they were. A good example of his exposition is "On population and environmental policy and problems" (In: Noel Hinricks, ed., *Population, Environment and People*, McGraw-Hill, 1971) in which he confuses pollution with environmental deterioration and then proceeds to do battle with a series of straw men.
5. The prize here must go to Sir Robert Robinson, Nobel Laureate organic chemist, for a classic blunder. In a letter to the *London Times* (Feb. 4, 1971) discounting the threat of leaded compounds to oceanic plankton, he began: "Neither our 'Prophets of Doom', nor the legislators who are so easily frightened by them, are particularly fond of arithmetic . . ." and then goes on to do some "simple arithmetic" (as he describes it) to show that the dilution of lead in the oceans will be so great that it will remain biologically negligible. Of course his whole exercise in "simple arithmetic" completely misses the point because of, among other things, the phenomenon of biological magnification — a process familiar to most undergraduate students in ecology. I often wonder when some physical scientists will learn that things are a bit more complex in the biological and behavioral sciences. As Garrett Hardin wrote in his brilliant new book, *Exploring New Ethics for Survival* (p. 31), "No great Chemist in the Sky stirs the ocean into one homogeneous soup. Lead enters the ocean in two ways: as fallout from the air, and as dissolved, suspended, and organism-bound matter in river water. River water is lighter than ocean water and tends to spread out on the surface — and it is here that *all* of the photosynthesis takes place. Below about 250 feet there is too little light for photosynthesis. We need to know how much lead there is in the first 250 feet of the ocean.

How much there is in the remaining 13,000 feet doesn't matter much. The 'window' through which lead enters is where the action takes place. The dynamic geometry of the earth system is quite different from that of a Waring Blender in the chemical lab."

6. "The Ecosystem Doom" by Theodore W. Schultz (*Science and Public Affairs, The Bulletin of the Atomic Scientists*, April 1972, pp. 12–17) shows that under some circumstances economists can be reduced to incoherence by the idea that their systems must operate within ecological constraints.
7. *Nature*, Jan. 14, 1972.
8. This view has been made explicit by plant physiologist Barry Commoner in his book, *The Closing Circle* (Knopf, 1971).
9. *Op. cit.*, p. 26.
10. Ehrlich, P. R. and J. P. Holdren, 1972. One-dimensional ecology. *Science and Public Affairs, Bulletin of the Atomic Scientists*, vol. 28 (May).
11. Ehrlich, P. R. and A. H. Ehrlich, 1972. *Population, Resources, Environment*, 2nd Edition, Freeman and Co., San Francisco; *Man's Impact on the Global Environment*, report of the Study of Critical Environmental Problems (SCEP), MIT Press, Cambridge, Mass., 1970.
12. Woodwell, George M., 1970. The energy cycle of the biosphere. In *The Biosphere*, W. H. Freeman & Co., San Francisco, p. 31.
13. Material on the Irish potato famine is from A. H. Barton, 1969, *Communities in Disaster*, Doubleday and Co., New York.
14. An excellent elementary discussion of the relationship between complexity and stability in ecosystems, including some exceptions to the rule, can be found in E. O. Wilson and W. A. Bossert, 1971, *A Primer of Population Biology*, Sinauer Associates, Stamford, Conn. A collection of papers indicating the intricacy of explaining the relationships will be found in *Diversity and Stability in Ecological Systems*. Brookhaven Symposia in Biology no. 22, BNL 50175 (C–56), 1969. Above all, it is well to remember that regardless of explanatory mechanisms the correlation of diversity and stability is well-established empirically.
15. Chedd, Graham, 1970. Hidden peril in the Green Revolution, *New Scientist*, 22 Oct.; O. H. Frankel and E. Bennett, eds., 1970, *Genetic Resources in Plants — Their Exploration and Conservation*. F. H. Davis Co., Philadelphia; H. Garrison Wilkes, 1971, Too little gene exchange. *Science*, vol. 171, p. 955.
16. Ehrlich, P. R. and P. H. Raven, 1965. Butterflies and plants; a study in coevolution. *Evolution*, vol. 18, pp. 586–608; P. R. Ehrlich, 1970, Coevolution and the biology of communities. *Proc. 29th Biology Colloquium*, Oregon State Univ. Press, Corvallis.
17. *Op. cit.*, p. 152.
18. *New York Times*, March 21, 1971.
19. *Op. cit.*, p. 30.
20. *Ibid.*, p. 49.
21. *Ibid.*, p. 55.

22. See either the Population Reference Bureau *1971 World Population Data Sheet*, available from the Bureau, 1755 Massachusetts Ave., N.W., Washington, D.C. or any recent annual volume of the *United Nations Demographic Yearbook*.
23. Coale, Ansley, J., 1969. The decline of fertility in Europe from the French Revolution to World War II. In S. J. Behrman and Leslie Corso, Jr., eds. *Fertility and Family Planning*, pp. 3-24. Technically the demographic transition is the change from a high death rate, high birth rate regime to a low death rate, low birth rate regime, such as has occurred historically in the developed countries. Most of those countries have had low birth and death rates since the 1920's, and now have birth rates well above death rates. For instance in 1971 Northern Europe had a birth rate of 16 per thousand and a death rate of 11. The birth rate in North America was 18 and the death rate was 9. Some demographers feel, even though there is no evidence for it, that somehow the demographic transition is an automatic process leading to a stationary population, and the older literature on animal population dynamics also is replete with such fanciful ideas. Even if this were the case, the obvious long lag-time would make depending on such processes a dangerous policy at best.
24. NRR is a measure of whether or not a population will be growing, stationary or shrinking — *when and if* the age composition stabilizes, and *if* age specific vital rates remain constant. See, for example, Nathan Keyfitz and Wilhelm Flieger, 1971, *Population Facts and Methods of Demography*. W. H. Freeman and Co., San Francisco, p. 55.
25. See, for example, Donald J. Bogue, 1969, *Principles of Demography*, Wiley, N.Y., fig. 3-4, p. 59.
26. On the momentum of population growth, *Demography*, vol. 8, pp. 71-80, 1971.
27. It is important to remember that in a young, growing population, achievement of replacement reproduction (NRR=1) does not lead to a stationary population (ZPG) until many decades later. For instance, even if the U.S. reaches NRR-1 this year, it will be well into the next century before our growth stops. (See Tomas Frejka, 1968. Reflections on the demographic conditions needed to establish a U.S. stationary population growth. *Population Studies*, vol. 22, p. 379-397.)
28. A fine, concise treatment of the problems of tropical agriculture is "The unexploited tropics" by Daniel H. Janzen (*Bull. Ecological Soc. of America*, Sept. 1970, pp. 4-7.)
29. This conclusion has recently been confirmed by the computer simulation work of Donella Meadows at M.I.T. based on data from villages in India.
30. Food and Agricultural Organization of the United Nations (FAO), 1971. *The State of Food and Agriculture*, p. 8.
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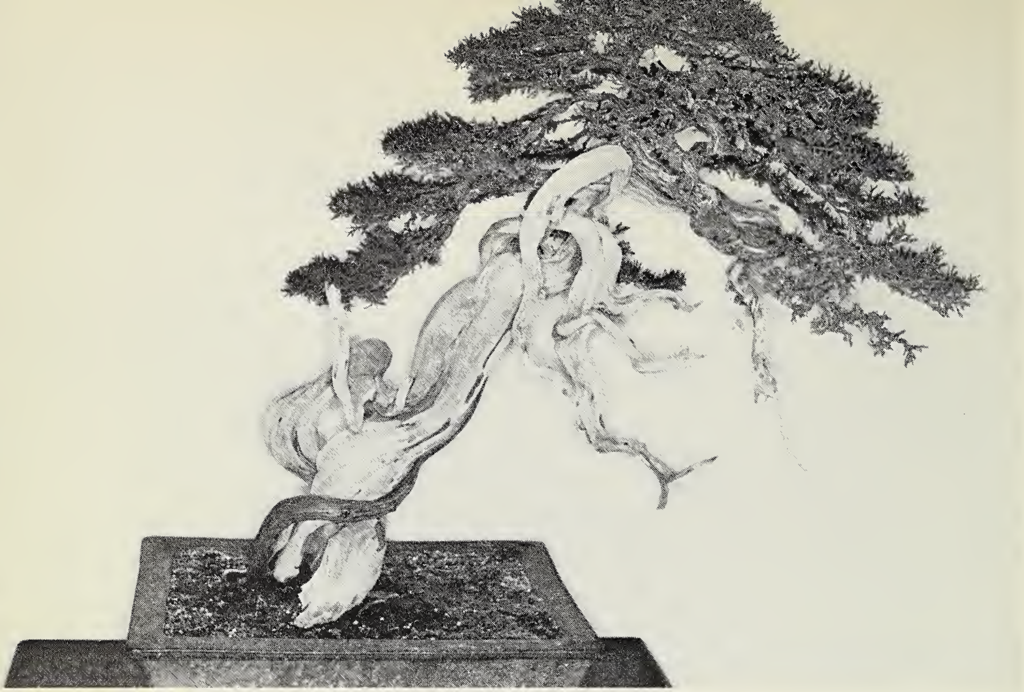
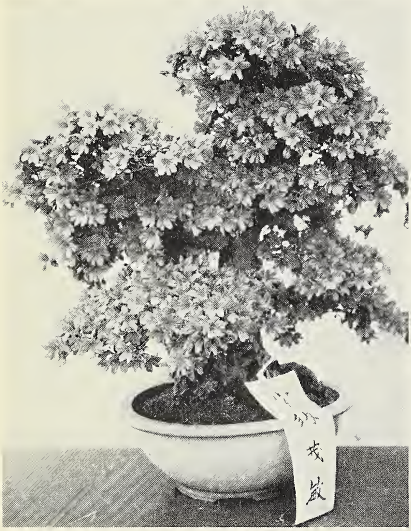
Japanese Bonsai and Bonsai Shows

Ever since those 17th and 18th century visits of Kaempfer and Thunberg — first European naturalists to discover its botanical wonders — Japan has been noted as a source of outstanding native plants for ornamental use in the temperate gardens of the West. Genera like *Aucuba* and *Pittosporum, Magnolia* and *Euonymus, Acer, Larix, Fatsia, Camellia* and *Cryptomeria* are typical of many which have contributed woody species now well known to western horticulture. Japanese horticultural techniques have not immigrated quite as rapidly as Japanese ornamental plants. But bonsai, the Japanese art of growing tiny trees and other woody plants in miniature, is one that has been booming in our country. It permits anyone with time, patience, a green thumb — and with only a few square yards of space — to have his own arboretum, in miniature.

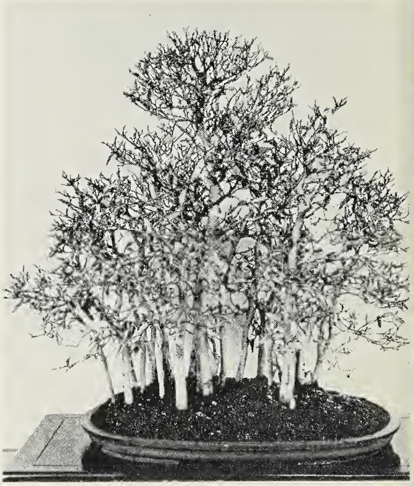
Bonsai as an art has been practiced in Nippon for at least 500 years. In a densely populated land, where living and garden space is very limited, the creation of miniature trees or tiny living landscapes for appreciation in the home makes good sense. Airy houses without central heating in a land of high humidity make for a good environment in which to display potted plants like bonsai which often have special attractions to the homeowner. Being compact a number of bonsai specimens can be maintained in minimal area. Thus, a mature though diminutive tree can be moved easily in and out of the house as desired — important where space is a premium — and where the custom is to focus attention and enjoyment to one art object at a time. Fine Japanese pottery and chinaware — as beloved as the plants themselves — are usually combined with choice bonsai specimens to yield outstanding conversation pieces. Depending upon the ability of the grower, one can bring into his house what appears to be a mature forest tree, a fragment of natural woodland, a clump of bamboo, a pine-clad islet, or a contorted windshorn conifer from some remote mountain top — all in miniature. In short, the art of bonsai permits the average Japanese to enjoy in his own home a tiny living replica of the natural landscape that he loves so well.



Chamaecyparis obtusa (*a representative conifer in unusual bonsai form*).

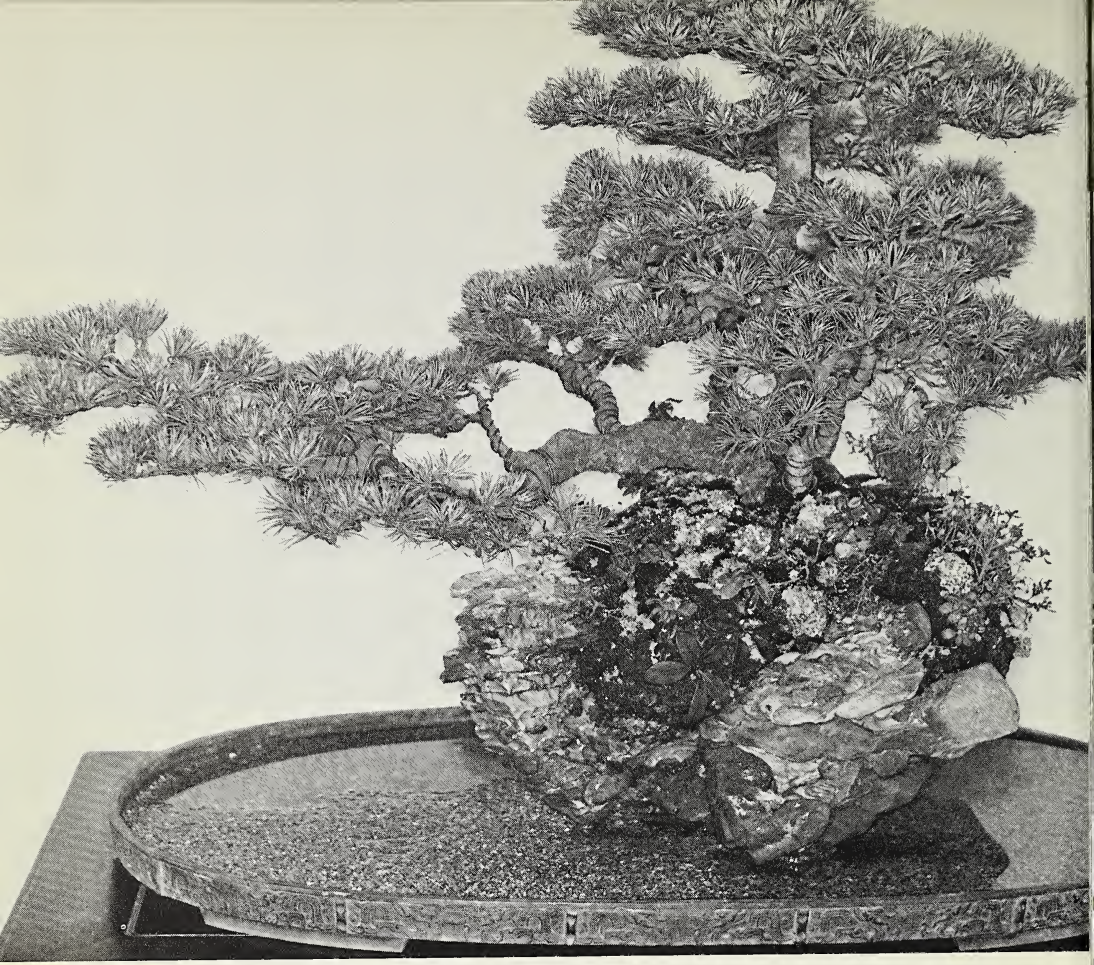


Azalea (an unusual bonsai subject, at least to westerners; specimen illustrated was "blue ribbon" recipient as best bonsai in annual azalea show at Kurume in Kyushu in 1967).



Fagus crenata (*to illustrate a group of trees as a bonsai subject*).

Right: Cycas revoluta (*an unusual and rather rare bonsai subject*). *All photos: W. H. Hodge.*



Pinus parviflora (*to show a favorite bonsai presentation of a rocky islet with dominating pine and related herbs growing on rocks and set in a low container with sand and water to represent the sea*). *Photo: W. H. Hodge.*

Wherever one travels in Japan, collections of bonsai are to be seen — on the racks beside windows or atop the roof of tiny city homes to the more spacious yards of the picturesque thatched farmhouses of Nippon's countryside. Anyone can be a bonsai owner from factory worker to a member of the Imperial Family. As likely as not, when the Japanese Emperor or Crown Prince speaks at a formal official ceremony he will stand in front of a golden folding screen along with one of his choice fine bonsai. Nurseries exist solely for bonsai production, and florists, garden shops, and even the big city department stores, regularly offer either specimen plants in attractive containers or plants simply "balled and burlapped" — in miniature, to be trained in "do it yourself" fashion. Even the stalls of itinerant peddlers who assemble at the innumerable shrine or temple festivals regularly feature examples of bonsai art — the plant subject being offered usually matching the season or the special holiday involved.

Japan's bonsai "aficionados", like most other collectors of specialized horticultural material, have their own unique societies. These are found all over the island nation. Like horticultural societies everywhere they foster annual exhibitions at a season appropriate for the material. Late winter or early spring is popular for most shows that display general bonsai material, but shows for specialty bonsai material must suit the season. Thus the city of Kurume in Kyushu — original source of many of the cultivars of our familiar "Kurume" azaleas, features a bonsai show devoted to these colorful plants in April; whereas chrysanthemum trained in bonsai form are featured of course in the autumn at the unique "mum" shows to be seen in many parts of Japan, principally in shrine gardens.

A visit to a more typical bonsai show gives one not only a glimpse of the wide variety of Japan's bonsai art but enables one to view some of the best existent specimens. Unlike an American horticultural show, a Nipponese bonsai display is simplicity itself. Show specimens are simply lined up in long rows against plain white background walls enabling the visitor to appreciate the full beauty of form and container without distraction. Low partitions separate each individual display, which often consists of two features — the major bonsai specimen plus a lesser container, the latter a dish garden of sorts for accent often featuring plants like dwarfed *Sasa veitchii*, creeping polypody ferns, prostrate ericads like *Vaccinium vitis-idaea*, or — if it's wintertime the New Year flower favorite, *Adonis amurensis*, which is commonly forced for bloom in this season. Displays are labelled simply with the common name of plant material and identification of the owner.

In Japan there is no real season for bonsai. Evergreen specimens, both needle-leaved and broad-leaved types, may be enjoyed the year around. On the other hand, the form and architecture of deciduous trees is often best appreciated in the leafless condition, and since those species with showy flowers are at their prime in early spring, this gives the rationale for many Japanese bonsai societies to schedule vernal shows.

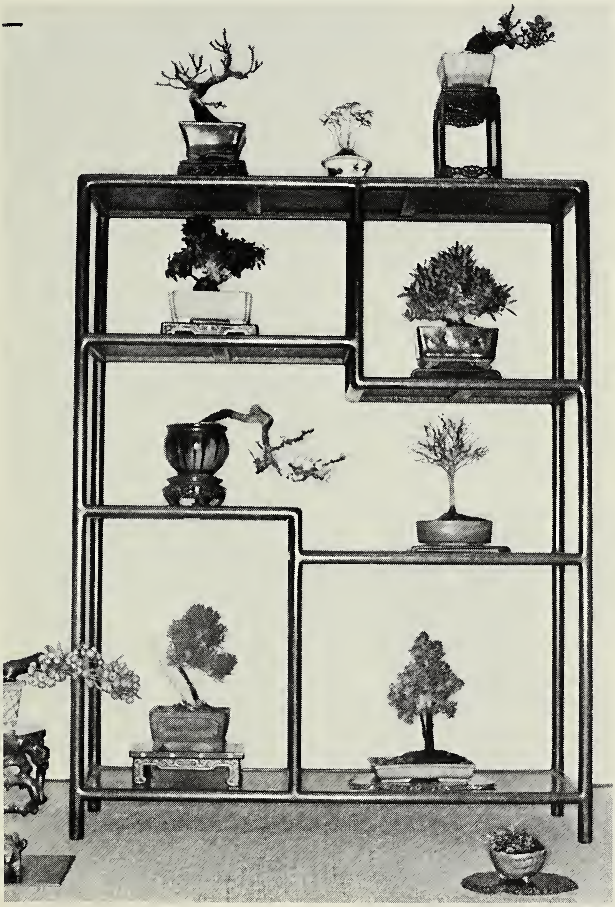
Three major kinds of bonsai art are represented in such general shows — single tree specimens, groups of trees planted to simulate woodland or copse, and lastly a complete landscape. In the latter case the favorite bonsai landscape is a representation of the microcosm of plants to be found on a typical coastal islet such as can be seen in the bay at Matsushima, one of the three famous "views" of Japan. The most common bonsai grown is the single specimen tree. Individuals may exhibit a wide variety of shape. Most obvious is the tree trained to be as exact a replica as possible of the ideal form and habit of the species found in nature. However, conifer bonsai often have branches and needle clusters clipped to give the ordered sort of beauty beloved by the Japanese and typical of full-sized specimens grown in manicured style in the landscape and shrine gardens of the country.

Of conifers trained as bonsai, "Goyo-matsu", *Pinus parviflora*, a familiar 5-needle pine of Japan's mountains, is most popular. The habit of this species lends itself well to bonsai art so it outnumbers all others in most Japanese shows. Not as frequent but often seen is "Kuro-matsu", *Pinus thunbergii*, the native black pine which produces the characteristic look to Japan's rocky seacoasts. Other favorite conifers trained as bonsai include "Hinoki" (*Chamaecyparis obtusa*), "Ezo-matsu" (*Picea yezoensis*) and mountain juniper, "Nezu" (*Juniperus rigida*) — with popularity about in that order. It is with certain of this coniferous material, especially "Hinoki", that Japanese bonsai artists are able to create those bizarre specimens which bring to the viewer a strong feeling of the continual battle for existence that certain conifers must make when growing in the inhospitable environment that exists at montane timberlines. Some of these seemingly wind and snow battered bonsai feature essentially a bleached and twisted woody core with only a fragment of living foliage. One wonders how the green crown can possibly be maintained with only a tiny umbilical cord of living bark snaking its way up the surface of the bare and dead heartwood to connect the leaves with the roots below.

As might be expected, varieties of Japanese cherries — the national flower, and the winter-flowering plum ("*ume*"), — one of the "three friends of winter", are the favored subjects for bonsai among flowering trees. Also commonly seen at shows as flowering bonsai are such plants as winter jasmine, native pieris, camellias, flowering quince and Cornelian cherry. Speci-

Miniature bonsai (a typical stand of "super-dwarf" bonsai showing a variety of subjects including pine, zelkova, cherry, flowering quince, firethorn, etc.). Photo: W. H. Hodge.

mens still colorful with fruits from the preceding fall are often represented by cultivars of ilex and firethorn. Of native deciduous trees exhibited three kinds — "*Momiji*" (Acer spp.), "buna" (*Fagus crenata*) and "Keyaki" (*Zelkova serrata*), are the obvious favorites. This is understandable, for in leafless silhouette choice bonsai of these species, though pygmy-sized, look just like full-grown trees transplanted from a Nipponese woodland. This impression is somewhat lost, it seems to this writer, after the leaves appear, for in size the latter are not quite in proportion to the over-all stature of the dwarfed plant. Some bonsai are even said to reflect the personality of their owners. Featured in a Tokyo show in 1968 was a bonsai from the collection of the late postwar statesman, Shigeru Yoshida. According to those who knew him his keyaki bonsai expressed beautifully the essence of this great Japanese premier in also being sturdy, upright and resolute in character!



As though standard bonsai are not dwarfed enough, some Japanese specialize in producing truly Lilliputian specimens. Many of the same native species to be seen in normal bonsai size may be used for producing these pygmies. Whereas the average bonsai creation may be grown in a shallow container measuring a foot or more across, these dwarfs — only inches in height — occupy tiny containers seldom more than two to three inches in diameter. Such miniature bonsai, where displayed, are usually grouped in collections of six or more, often on decorative wooden stands, usually lacquered. An outstanding display at one recent show featured a series of pygmy plants — including pine, keyaki, cherry, ume, flowering quince and firethorn — each grown in its original tiny container for over 40 years!

Actually any description of Japanese bonsai shows should not close without reference to the container in which it is grown and displayed. To the bonsai artist it is essential that the container complement the form and character of the living plant itself. Each Japanese bonsai seems always to be in complete harmony with its container. Furthermore, the container and plant also appear always to be in balance with the stand or base used to display this living art. It seems almost as though the plant was created for the accessories and vice versa. A dwarf keyaki tree with solid bole — or an ume with old angular trunk fits perfectly into a squarish low-key container; a winter cherry whose dark trunk supports branches full of bright blossoms is appropriately grown in a dark container also decorated with bright flowers; or a knobby pot and intricately-turned wooden stand will be used to set off an old hinoki tree with its marvelously contorted trunk. So it goes. Bonsai as Japanese horticultural art may be booming in western countries but it is obvious that it may take a few more centuries of experience before we can match the bonsai masters of old Nippon.

W. H. Hodge
Section Head
Ecology and Systematic Biology
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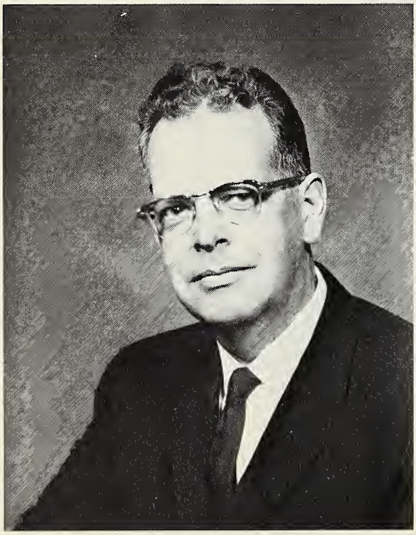

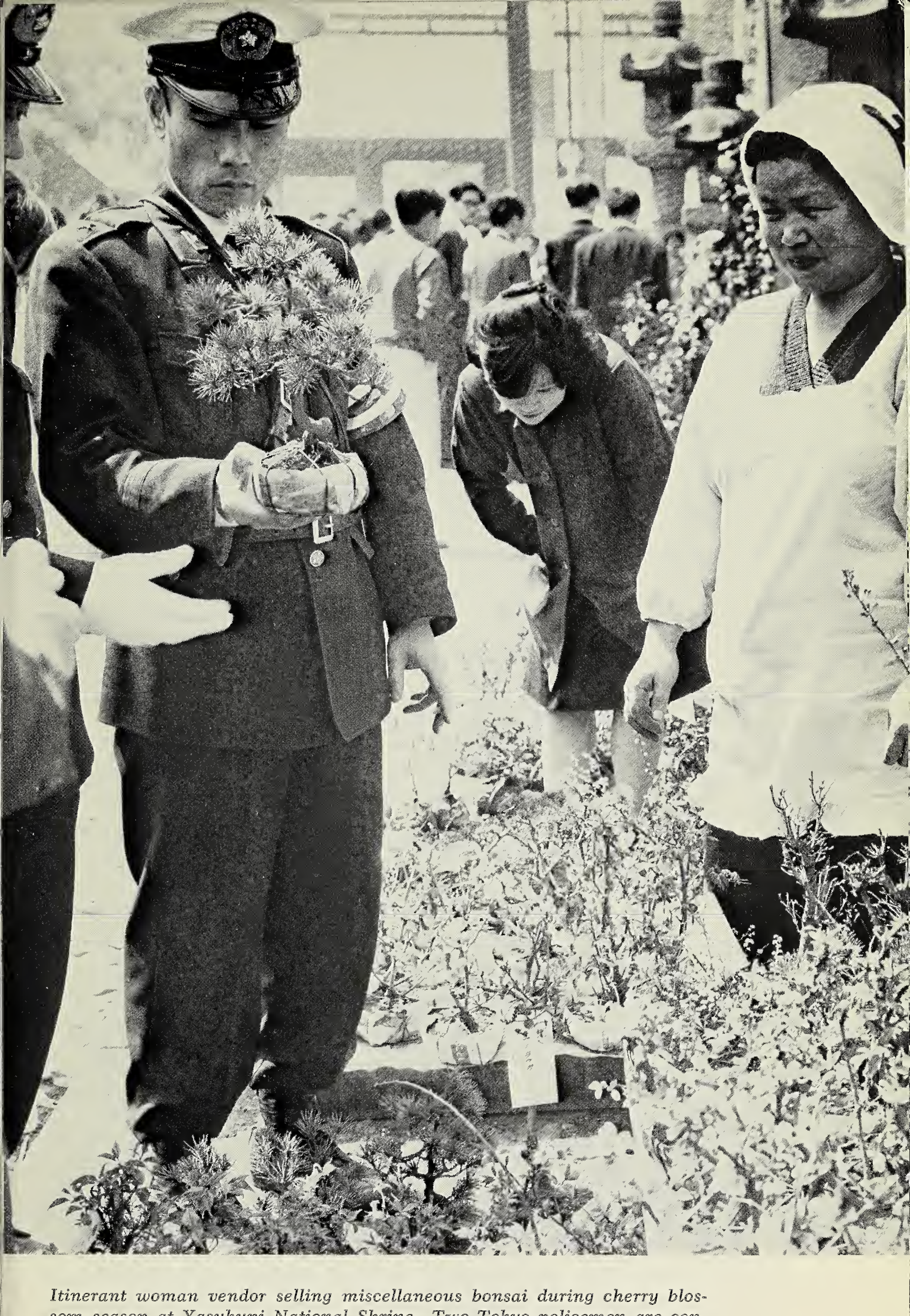

Itinerant woman vendor selling miscellaneous bonsai during cherry blossom season at Yasukuni National Shrine. Two Tokyo policemen are considering purchase of a pine (simply "balled and burlapped") grown for bonsai training. Photo: W. H. Hodge.

ARNOLDIA *is a publication of the Arnold Arboretum of Harvard University, Jamaica Plain, Massachusetts, U.S.A.*

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ARNOLDIA

The Arnold Arboretum *Vol. 32, No. 6* *November 1972*

Contents

249 The Director's Report

277 Plant Registration
Robert S. Hebb

289 Notes from the Arnold Arboretum
Weather Station Data

290 Abnormal Leaf Retention on Introduced Trees in Autumn 1971
Alfred J. Fordham

292 Arnoldia Reviews

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Cover: Arnold Arboretum field class led by Dr. Richard Weaver.
Photo: P. Bruns

The Director's Report

THE ARNOLD ARBORETUM DURING THE FISCAL YEAR ENDED JUNE 30, 1972

A bequest from the estate of James Arnold was accepted by the President and Fellows of Harvard College in 1872, and so began the Arnold Arboretum. Nineteen hundred seventy-two was designated the Centennial Year, and a special program was planned for May 21–28 to which botanists and horticulturists throughout the world were invited. Approximately 700 persons accepted the invitation and attended one or more events or participated in the full Centennial week. Twenty-seven states, 10 foreign countries, 46 organizations, and 69 institutions were represented by the guests.

Headquarters for the program were at the Sheraton-Plaza Hotel, where a formal banquet was held, as well as a day-long symposium with 12 papers given on the topic, "The Potential of Arboreta and Botanical Gardens". During the week special lectures were offered at the Harvard Business School to the Friends and to the public. Registrants had their choice of three days of botanical or horticultural tours of native vegetation or of private gardens in eastern Massachusetts; in addition, guided tours of the Arnold Arboretum facilities and collections in Jamaica Plain, Weston and Cambridge were offered.

An exhibit of botanical books, treasures from the Arnold Arboretum library, was displayed in Houghton Library, and a special booklet, *Early Botanical Books*, was published to accompany the display. A color film on the Arnold Arboretum was prepared for a premiere showing during the week and is now available for rent. The film explains the activities, goals and resources of the Arboretum and its staff.

At a final buffet supper, held at the Arboretum in Jamaica Plain, awards of Jewett prizes were made to four horticulturists. Although the staff attempted to dissuade its colleagues and related organizations from the presentation of greetings, many brought them anyway, and these symbols of appreciation and respect were gratefully received.

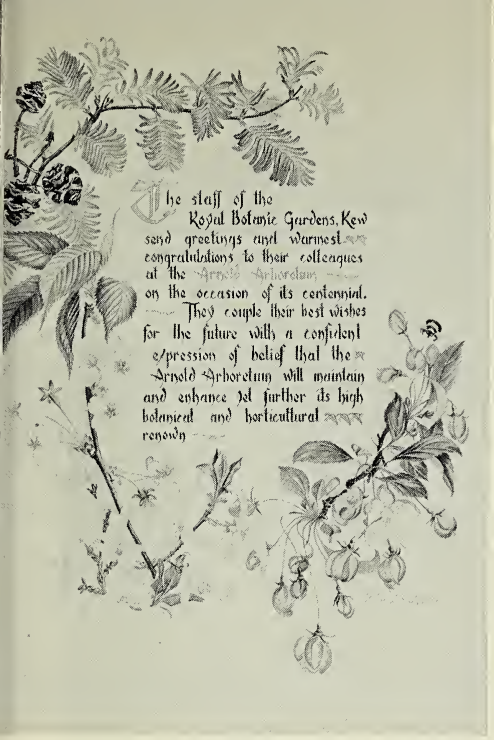
The program could not have been accomplished without the participation and cooperation of many volunteers, headed by a Centennial Committee under the chairmanship of Rear Admiral Harry Hull, U.S. Navy (Ret.), of Manchester, Massachusetts. Organized into subcommittees, these individuals assumed responsibility for various aspects or days of the program, and arranged for the guides and the hospitality extended. A finance subcommittee undertook with success the task of raising sufficient funds to cover the expenses of the program for which Miss Harmony Clement served as staff coordinator. The staff is grateful for all this support.

Especially noteworthy was the excellent publicity obtained, not only during the week, but before and after the celebration. Many magazine articles, TV and radio spot features and announcements, and especially a feature section of the *Boston Globe* drew attention to the celebration and the grounds.

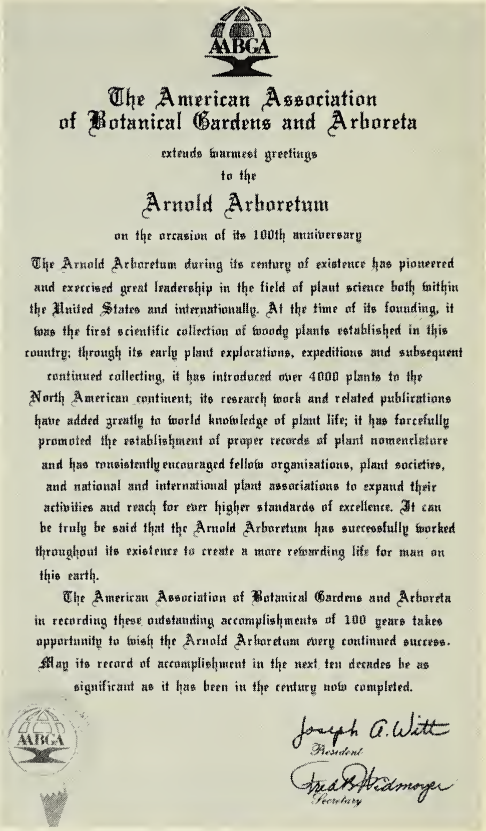
Visitations to the collections increased several fold. Displays of photographs and sometimes plant material, historical or current, were presented in Widener Library, the Boston Public Library, and many suburban libraries; also in Holyoke Center, Boston City Hall, and the Arnold Arboretum administration building. Requests for these displays have now been received from other botanical gardens and arboreta, and several traveling displays have been created by Miss Pamela Bruns of the staff.

As a part of the Centennial, the staff wished to emphasize the historic and present role of the Arnold Arboretum in the introduction and distribution of plants. Through the cooperation of William Flemer of the Princeton Nurseries, seedlings of *Cercidiphyllum japonicum* were grown and distributed to all members of the Friends of the Arnold Arboretum. A large balled shrub or tree was offered to every garden club in New England, and 153 organizations accepted the gift for ceremonial planting in a conspicuous public spot. Considerable newspaper publicity resulted from this cooperative effort. Every college and university in the United States with a department of botany or horticulture also was offered a gift plant of educational or teaching value; this offer was accepted by 112 institutions.

Finally, every botanical garden and arboretum in the International Directory of Botanical Gardens was offered propagating material of some classic type plant within the Arboretum collections. To the present, 600 propagules have been sent to 70 institutions, and a backlog of requests remains to be filled



The staff of the
Royal Botanic Gardens, Kew
send greetings and warmest
congratulations to their colleagues
at the Arnold Arboretum
on the occasion of its centennial.
They couple their best wishes
for the future with a confident
expression of belief that the
Arnold Arboretum will maintain
and enhance yet further its high
botanical and horticultural
renown



AABGA

The American Association of Botanical Gardens and Arboreta

extends warmest greetings
to the

Arnold Arboretum

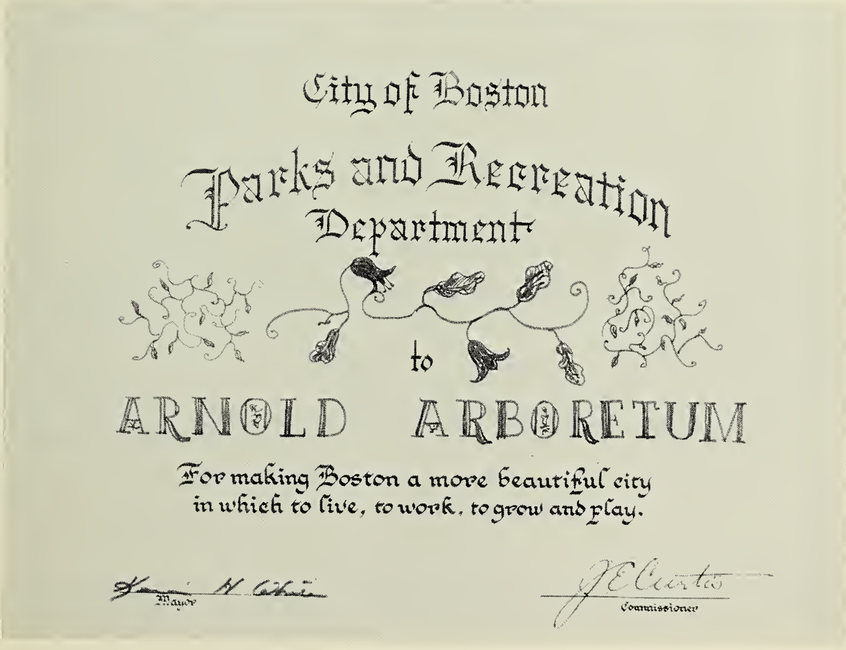
on the occasion of its 100th anniversary

The Arnold Arboretum during its century of existence has pioneered and exercised great leadership in the field of plant science both within the United States and internationally. At the time of its founding, it was the first scientific collection of woody plants established in this country; through its early plant explorations, expeditions and subsequent continued collecting, it has introduced over 4000 plants to the North American continent; its research work and related publications have added greatly to world knowledge of plant life; it has forcefully promoted the establishment of proper records of plant nomenclature and has consistently encouraged fellow organizations, plant societies, and national and international plant associations to expand their activities and reach for ever higher standards of excellence. It can be truly be said that the Arnold Arboretum has successfully worked throughout its existence to create a more rewarding life for man on this earth.

The American Association of Botanical Gardens and Arboreta in recording these outstanding accomplishments of 100 years takes opportunity to wish the Arnold Arboretum every continued success. May its record of accomplishment in the next ten decades be as significant as it has been in the century now completed.

Joseph A. Witt
President

Fred B. Widmoyer
Secretary



City of Boston
Parks and Recreation
Department
to
ARNOLD ARBORETUM

For making Boston a more beautiful city
in which to live, to work, to grow and play.

Mayor

J. E. Curtis
Commissioner

at the proper season for taking such cuttings in Massachusetts and for their receipt in diverse geographic and climatic areas. Special plants offered to Boston area organizations were accepted by such groups as the Museum of Science, the Public Garden, Case Park in Weston, and the Boston Center for the Performing Arts.

Several organizations holding annual meetings in the Boston area asked for special programs or guided tours of the Arnold Arboretum during the year. Since such requests and others are becoming more frequent, and often beyond the capabilities of the staff, a pilot program was launched to train a small group of volunteers to serve as guides to the Arnold Arboretum collections or to help in other capacities. Coordinated by Mrs. Paul Wechsler, the program was comprised of 15 four-hour instructional sessions covering a period of seven months. After practice talks and runs with the staff as an audience, the volunteer guides were used regularly on tours. Throughout our activities we have gained immeasurably from their assistance to the staff in many service roles.

It is impossible to list here all the individuals who contributed so significantly to the success of the program. We can only indicate our deep gratitude. It is equally difficult for me to express adequately the credit due the staff. Any director who wanted such a program could not have had more support than was given by the staff of the Arnold Arboretum in honoring its 100 years.

The regular work of the Arnold Arboretum was maintained during the year, and its details form the remainder of this report.

Staff

Three resignations were accepted during the year. Dr. Thomas Elias, who had been working with Dr. Wood on the preparation of a generic flora of Southeastern United States, accepted a position January 1, 1972 as dendrologist of the Cary Arboretum being developed by the New York Botanical Garden. Mr. C. Robert Long, librarian of the Arnold Arboretum and the Gray Herbarium, also accepted a position in the library of the New York Botanical Garden. Mrs. Heidi Duda, cataloguer on a joint appointment, resigned to work elsewhere in the Harvard libraries.

Dr. Carroll E. Wood, Jr., was appointed Professor of Biology at Harvard while retaining his title and role as a curator of the Arnold Arboretum. Miss Nancy Page, Mercer Research

Fellow for part of the year, was appointed Coordinator for Community Activities at the Arboretum.

Dr. Lorin I. Nevling, Jr., assumed additional responsibilities for curating the collections of the Farlow Herbarium while its director is on sabbatical leave. He has been given a special title of Coordinator of Botanical Systematic Collections.

Honors and awards came to three staff members. Mr. Alfred Fordham was honored by the International Plant Propagators Society with their Award of Merit. This award is presented only occasionally to "exceptionally gifted propagators in very special recognition of skills in plant propagation." Dr. Donald Wyman, horticulturist emeritus, was honored at the American Horticultural Congress held in Milwaukee with the receipt of the Liberty Hyde Bailey Medal, the highest award of the Society. Dr. Richard Howard received the gold medal of the Garden Club of America at its annual meeting in Memphis, Tennessee with a citation for eminence as a botanist, horticulturist, educator, and author. Professor Charles Sargent received the first award of this medal, and Dr. Wyman also has been a recipient. Dr. Howard also was elected vice-president and president-elect of the American Association of Botanical Gardens and Arboreta.

Community Service

With the appointment of Miss Nancy Page as Coordinator for Community Activities for the Arboretum staff, we have been able to centralize the requests for staff assistance on ecological problems and neighborhood beautification projects. During the year Miss Page was appointed a member of the City of Cambridge Conservation Committee, and is chairman of the Cambridge Tree Committee. The city plans associated with the proposed Kennedy Library have included a proposal for a parking garage under the Cambridge Common, and the beautification of Harvard Square.

Miss Page has worked with Dr. Weaver and Miss Ida Hay of the staff in a survey of the common trees of Boston, which led to the special article in *Arnoldia* on Boston trees. This has been reprinted as a separate presentation for distribution to the city schools. Further work is in progress on the common plants other than trees. A national committee was established to commemorate the birth of Frederick Law Olmsted, and a local area credited to Olmsted's design was proposed as the Olmsted Park District. The staff was requested to survey, map and name the significant trees within this area.

The staff has cooperated with many groups, as indicated in the last report, but new ones are formed every year. Additional organizations requesting our assistance this year were Neighborhood Youth Corps in Roxbury, Somerville, Charlestown and Chelsea. Schools also were concerned, and help was offered the Massachusetts College of Art, the St. Francis de Sales School, and the Hurley School. We also have worked with the Boston Transportation Planning Review Committee; the BRA Tai-Tung project in Chinatown; the City of Boston Department of Parks and Recreation; and the Metropolitan District Commission, in offering instructional programs for residents or employees. Dr. DeWolf and Miss Page offered a special course at the Arnold Arboretum for the Boston Society of Landscape Architects under the title "Planting the City: Urban Stresses". Dr. Nevling served as chairman of a Cabot Estate advisory committee appointed by Mayor White of Boston.

Interest in beautification and a concern for environmental problems spread to Harvard University as well. Students requested that the University concern itself with recycling of dormitory waste, dogs in the yard, and problems of grass and trees. The result of their interest was the formation of a "Green Committee." Dr. Howard represented the Arboretum in the study sessions, and a redesign and planting of the area around Thayer Hall was completed before Commencement. The Arnold Arboretum supplied the landscaping plant materials.

During the year special publicity drew the attention of the public to the Boston Poison Center operated by the hospitals of Boston. All calls concerning plant materials are referred to the Arboretum during working hours, and to individual staff members during the evening.

Identification of plant specimens and problems of cultivation, maintenance, and plant diseases continue and have increased due to the public's greater awareness of the Arnold Arboretum as a result of the Centennial publicity

Horticulture

Much effort was devoted to improving the appearance of the grounds at Jamaica Plain and Weston for the Centennial visitors. Unhappily, the weather was not cooperative. A dry fall, with a late freeze, was followed by a mild winter, causing apprehension among the staff regarding the development of bloom. Normal fall planting from the nursery collection was curtailed, with 211 taxa added to the grounds in the fall and only 125 in the spring. The spring planting was largely in the dwarf or slow-growing conifer grouping in the greenhouse area.

Spring can only be described as wet and cold — the only week of sunshine was that of the Centennial program. The grounds, however, had been enhanced with the addition of over 2,000 bulbs planted around the administration building and on the adjacent hillside by volunteers from Mr. Hebb's gardening classes and the staff. The spectacular blooms in the spring drew admirers, not vandals, to our surprise.

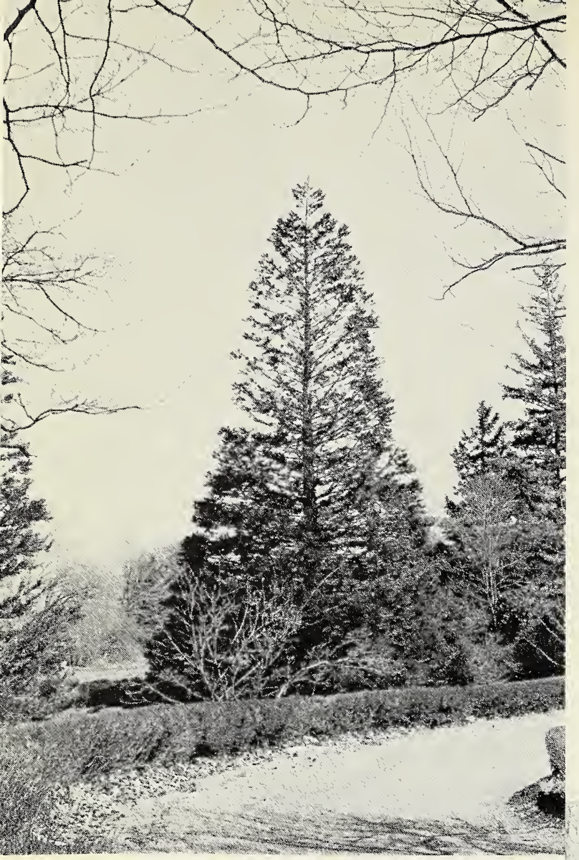
New identification signs, of letters carved in large planks, were erected along Route 1 and at the entrance gates on the Arborway within the Arboretum grounds.

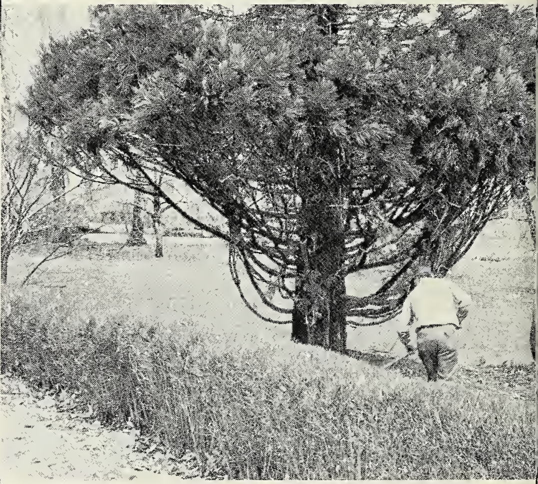
As the Centennial week began, the lilacs were mostly in tight bud, but the following five days of sunshine opened the flowers so that a good display was evident on the closing day and the week-end.

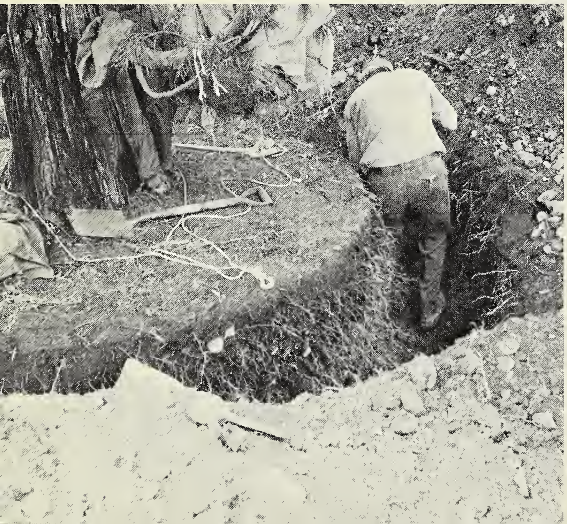
The major transplanting event of the year was the acquisition of a 42-foot specimen of *Sequoiadendron giganteum* from the estate of the late Chandler Hovey in Chestnut Hill. In the early 1940's Mr. Hovey acquired seven redwood saplings from California. One was given to the Arboretum, but it failed to survive in the location chosen, the top of Hemlock Hill. Since the others grew well in the Boston area, Mr. Hovey decided to donate a larger plant to the Arboretum for its Centennial; regrettably, he did not live to accomplish the gift. His estate was sold to Boston College, but Father Seavey Joyce, aware of Mr. Hovey's wish, offered a tree. A Friend made the gift that permitted our acceptance of the plant, which was moved by Frost and Higgins since the Arboretum does not have equipment to handle so large a specimen.

The original plan was to root-prune the tree in 1972 and move it a year later. When the trenching operation revealed no large roots outside of a projected ball, it was decided that the tree could be moved in one operation. In early May a site was chosen within the conifer collection where the *Sequoiadendron* would be protected from winds, and where other tender species were known to survive. The site, adjacent to a brook, also offered adequate water even in dry summers. Thus this large redwood was moved through the streets of Chestnut Hill to the Arboretum where it stands as a magnificent Centennial gift and memorial to Mr. Hovey. The Arboretum supplied to Boston College a collection of smaller trees and shrubs to relandscape the area vacated by the giant redwood.

Moving Day for the Sequoiadendron giganteum







Photos: R. Hebb

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HIGGINS

The card catalogues containing records of the plants in the collections of the Arnold Arboretum were incorporated into the data files of the Plant Records Center of the American Horticultural Society. After considerable work in preparation by Messrs. Hebb and Link, all the records were microfilmed by the Records Center staff, and the data processed for computer sorting. Printouts of these records in several programs are now on hand.

The goal of the Plant Records Center is to process the records of all gardens in North America, and eventually to have a comprehensive inventory of the horticultural collections in one master file. The microfilm of our current records offers additional protection to our collections because of its separate storage. With the aid of the computer, additions, deletions, corrections, and new printouts permit us to have an up-to-date record of the living collections. This work of the Plant Records Center has been supported by a grant from the Longwood Foundation.

The Arnold Arboretum serves as the registration authority for names of cultivars of woody plants proposed by horticulturists in the United States. A listing of new registered cultivars is published annually in *Arnoldia.* The data accumulated in this work, often supported by herbarium specimens or living plants, permits the staff to be aware of new introductions and their origin. Work has begun on a new edition of Rehder's *Manual of Cultivated Trees and Shrubs* through the kindness of an initial gift of an anonymous donor. A collection of current nursery catalogues has been assembled, and the horticultural and botanical literature is being screened on a regular basis for nomenclature changes. At present there are nearly 500 taxa, mostly cultivars, which are not in our collections. These are offered by American nurseries and are potentially hardy in the Boston area. Although many of the species have been tried in the past and proved to lack hardiness, it is hoped that new ecotypes may be available, and plants are being requested.

The Arnold Arboretum has in its endowment a fund established in memory of James R. Jewett. According to the terms of the gift, prizes are to be awarded occasionally for work on the improvement of beach plums or other small native or introduced fruit or nut bearing plants. During the Centennial program four prizes were awarded: to Dr. George Darrow of Beltsville, Maryland; Dr. Richard A. Jaynes of New Haven, Connecticut; Mr. E. M. Meader of Rochester, New Hampshire;

and Dr. George R. Slate of Geneva, New York. The contributions of these four men were considered meritorious, and appropriate to the terms of the Jewett fund.

Unauthorized driving of cars, motorcycles and bicycles within the Arboretum continues to plague us, is a hazard to visitors, and even results in damage to collections. Any enforcement of the Park Department regulations by the Boston Police is sporadic or lacking. Thus additional driving gates have been locked during the year in an attempt to control a potentially dangerous condition. A private detective agency has been hired again to patrol the grounds in the evening hours in order to offer a modicum of control and protection of visitors and plantings. Nevertheless, 17 vandal fires occurred on the grounds, five of which caused damage to collections. The administration building was broken into twice during the spring on week-ends, with resulting thefts of personal items and desk equipment. A policy of establishing locks on fire doors now divides the building into smaller segments, but causes inconvenience to staff members who wish to work week-ends or evenings.

The greenhouse staff carried additional heavy responsibility during the Centennial year. The special effort to distribute plants to members of the Friends, to colleges, clubs, and other botanical gardens was accompanied by extra activities. Special gift plants were prepared for visiting groups, and packages of pretreated seeds were included in table envelopes for the participants in the Centennial banquet. In preparing plants for mailing, and in filling seed envelopes, the staff was aided materially by a dedicated group of volunteers.

We continued to receive requests for propagating material from plants in our living collections for culture or research by individuals or institutions. During the year, 141 shipments were made of 652 taxa to 12 countries. We received 179 shipments of 794 taxa from 24 countries, largely in response to our requests for seeds to add taxa to our own collection or for the research of the staff.

The greenhouses always are open to professional visitors and to scheduled classes from Harvard or other colleges. Thirteen colleges scheduled one or more classes in the greenhouse during the year. One day a week the greenhouses also are open to the general public; the volunteer guides have been most helpful in answering the telephone or instructing the public on these open days.

Prior to the Centennial program, a gift of plants of succulents and cacti was offered by the Dartmouth College Department of

Biology to enhance the teaching and display collection. The local chapter of the Bromeliad Society has been meeting at the Dana Greenhouses. This group, under the leadership of Mr. and Mrs. Paul Wechsler, reconditioned and added plants to the collection of Bromeliaceae.

For the fifth year a student at Jamaica Plain High School, Mr. Brian J. Waldron, received the Arnold Arboretum Achievement Award. This award, financed initially by a Friend of the Arnold Arboretum, is offered annually to the most promising botany or horticulture student in the Boston area. The award is a selection of books, plant materials for a project of the recipient's choice, and a certificate.

Case Estates

The 110-acre property in Weston is an isolated but significant part of the operation of the Arnold Arboretum. It serves as a nursery and growing area for young plants and a reserve area for taxa which cannot be accommodated in the Jamaica Plain collections. The Case Estates are used for education programs and for demonstrations as well. Classes and lectures are offered on a regular basis in Weston. The number of visitors during the year increased noticeably, and auto traffic on the gravel driveway caused us to have this area hardtopped. The available water supply has proved inadequate in recent years. When the town of Weston was installing new water mains on Wellesley Street, we used the opportunity to install a new 8″ water line to the property; later, as time and money permit, feeder lines can be added to the individual nursery areas.

The town of Weston has plans to widen Wellesley Street fronting most of the Case Estates. This will result in a loss of land and necessitate the moving or abandonment of several stone walls and of some spectacular row plantings. In anticipation of this future action, we have begun barrier plantings in several areas.

The pruning demonstration area received needed attention this year when three talented students from the University of Massachusetts were available for summer employment. Older reserve collections also received much needed pruning.

A volunteer group of eight graduates of Mr. Hebb's practical gardening class contributed many hours of additional work on the low maintenance garden, the ground cover plots, and the demonstration beds. A gift of plants from Mr. and Mrs. Paul Rogers of Charlton, Massachusetts formed the nucleus of an herb demonstration area which received a favorable reaction

Case Park planting and monument. Photos: G. DeWolf from participants in the annual meeting of the American Herb Society, held in part at the Case Estates.

Many visitors have admired the rock garden area near the Red Schoolhouse which has been the personal effort of Mr. George Pride. Miss Marion Case originally had a rock garden in the same area but it was abandoned over the years and the site was planted to junipers. Now reclaimed, the area is most attractive with large collections of Sedums, bulbs, and small alpine plants.

Personal vegetable gardens of staff members also attract the attention of visitors, as do the special areas of research collections or the trial plantings of new ornamental herbs. Mr. George Pride maintains a breeding program in Iris and tetraploid Hemerocallis. During the year one of his seedlings won the Junior Citation, the highest award of the American Hemerocallis Society for a new seedling.

The collection of true lilies in demonstration beds has been mentioned in previous reports. It was anticipated that such a display might decline or be decimated by disease, leaving only the most hardy taxa, and this has happened. We were offered a collection of several hundred bulbs of unnamed hybrids of *Lilium auratum* × *L. speciosum* with the request they be planted in mass and the same selection process be permitted. An unused area of the nursery was available and Mr. Pride has undertaken to evaluate the quality of the flowers and record the erosion of the collection. The first flowering occurred in 1972 and was spectacular.

To honor the Centennial of the Arnold Arboretum the garden clubs of Weston commissioned Mr. John Wacker to landscape a small area near the Case Estates. The Arboretum was able to supply some of the plants chosen for the planting which was formally dedicated as Case Park.

Herbarium

A new program has been established by the National Science Foundation to support curatorial activities of systematic collections of national significance. An application for support was submitted jointly on behalf of the Arnold Arboretum, the Botanical Museum, the Farlow Herbarium and the Gray Herbarium. Dr. Lorin Nevling was indicated as the principal investigator. In March we received notice that a grant of $180,000 was approved for the first of five years of support. The Arnold Arboretum portion of the grant will be used during the first year to reduce the backlog of unmounted and therefore unavailable herbarium specimens; to increase the curatorial staff; to repair and rebind classical volumes in the library; to purchase additional library stacks; and to contribute toward general supplies and postage. If additional space becomes available, future grants will be used to purchase herbarium cases. Portions of the grant to be applied to the other organizations will be used in comparable ways.

On June 30, 1972 the total herbarium of the Arnold Arboretum reached 971,248 specimens, of which 149,057 represent cultivated plants housed in Jamaica Plain. Specimens accessioned during the year totaled 11,312 and 15,128 were mounted. New specimens came from Asia, the United States and Canada, tropical America, Europe and Africa respectively.

The increase in activity of mounting collections also increases the storage problem in the Harvard University Herbaria. Nearly 50% of the steel herbarium cases are now surmounted by two units of cardboard storage cases for herbarium specimens. This must be considered a temporary measure, for access to the specimens in the cardboard boxes requires the use of ladders and an additional amount of personal time. The arrangement is far from satisfactory.

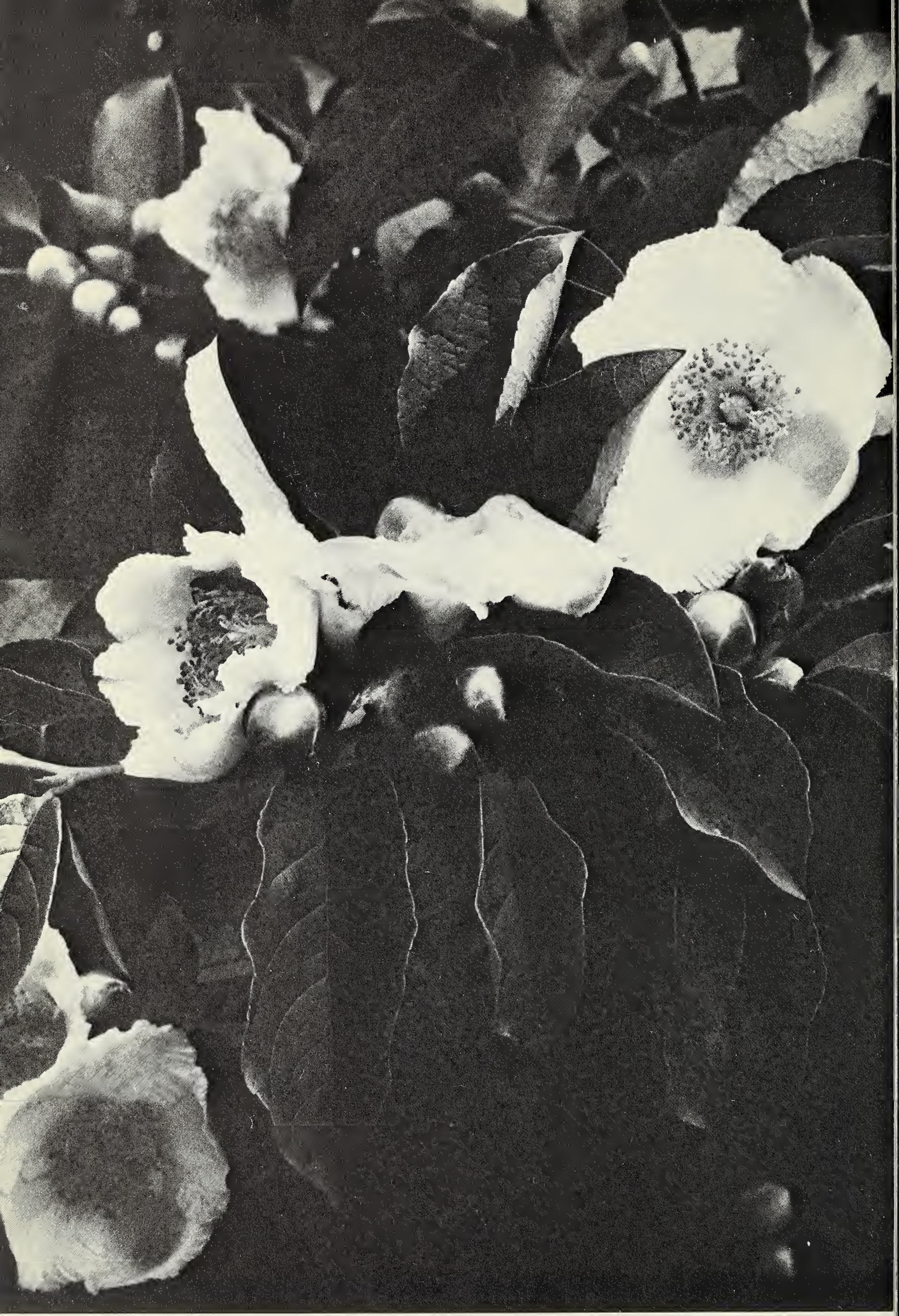
Requests for loans of herbarium specimens increased greatly during the year, reaching a point in excess of any demand since the early 1940's. No explanation is obvious. The combined herbaria filled requests for 201 loans to 88 institutions; 58 in the United States and 30 foreign. The average loan comprised 117 sheets. The staff asked for 45 loans from 16 United States and 12 foreign institutions, and the average loan received comprised 72 specimens. Student use accounted for 35% of the loans and 52% of the specimens.

The figures are disproportionate due to the activities of Dr. Howard, who has received much old material of plants collected a century ago in the West Indies. These specimens, long stored unnamed in the Museum of Natural History in Paris, are offering fascinating bits of information on the dates of introduction of plants cultivated in the old botanic garden at Saint Pierre on Martinique, and at the Camp Jacobs experimental station on Guadeloupe. Many of the collectors are known, but some names new to West Indian botany appear on the collections, presenting biohistorical problems to be worked out in the future. Two large loans of Piperaceae were requested by Dr. Howard to straighten out the confused nomenclature and biology of this group of high endemism in the Lesser Antilles.

Monographic and floristic studies are the research interests of the herbarium staff. Dr. Hu spent part of the year in Hong Kong and the New Territories in continuation of her studies of that flora. Dr. Nevling travelled to Veracruz, Mexico, where his work on the indigenous flora is being conducted in cooperation with Dr. Arturo Gómez-Pompa of the University of Mexico and its staff. Identifications and bibliographic work are completed in Cambridge. Dr. Carroll Wood and associates continue to prepare family treatments for a generic flora of southeastern United States. Dr. Howard made a brief trip to St. Vincent in midwinter for material for his work on the Lesser Antilles. Publications derived from these studies are listed in the bibliography of the staff.

Renewed interest in the condition of the wood collection developed following the symposium paper of Dr. William Stern during the Centennial. Dr. Ralph Wetmore has written the history of the collection, which was accumulated primarily from the research of Professors Jeffrey, Wetmore and Bailey. Recognized as the largest university held collection, it is an adjunct to the systematic biological work of many university staff members. Comparative and descriptive plant anatomy has been in a decline throughout the world in recent years. The wood collection has received a minimum of curatorial attention, and certainly its potential is no longer exploited. The NSF grant will permit additional curating, but there is a need for a scholar in this area, or at least a full-time curator-research assistant.

Materials from this collection are sent on loan when requested. Wood samples and slides are added to the collection when available from local research projects and when received in exchange for samples from the collection or from the herbarium. Slides of wood, pollen and leaves of 94 families were added to the collection during the year.



Stewartia koreana. *Photo: P. Bruns*

Library

Mr. Charles Long, librarian, jointly appointed by the Arnold Arboretum and the Gray Herbarium, resigned at the end of the fiscal year. Mrs. Norton Hall, formerly at the Hillis Library of Radcliffe, was appointed to succeed him. Mrs. Heidi Duda, a joint appointee as cataloguer, also resigned at the end of the year.

The crowded conditions in the library in Cambridge were alleviated by the addition of sections of new stacks at the ends of rows, but at the expense of desk and reading space within the stack area. The entire library was shifted in a Herculean effort to use the new space. In a fundamental change, Princeton files were adopted for storage of reprints and pamphlets, especially in the monographic section.

In the Jamaica Plain library, Mrs. Sheila Geary completed the tasks of bringing the catalogue up to date and of organizing the collection of nursery catalogues and publications on botanical gardens. New shelf lists have been completed in both libraries.

Funds from HEW were available through the University under the MA 5 Program to teach basic clerical-library skills. One trainee was chosen to participate in the program of 20 hours per week of on-the-job training and 15 hours of formal instruction each week at the Personnel Department.

As of June 30, 1972, the catalogued collections of the Arnold Arboretum library contained 80,613 items. During the year 585 volumes were bound, rebound or restored. Part of this was accomplished with a matching fund grant from the Council on the Arts and Humanities of the Commonwealth of Massachusetts. A total of 16,458 cards was added to the files in an effort to increase the value of the card catalogue by cross references.

Education

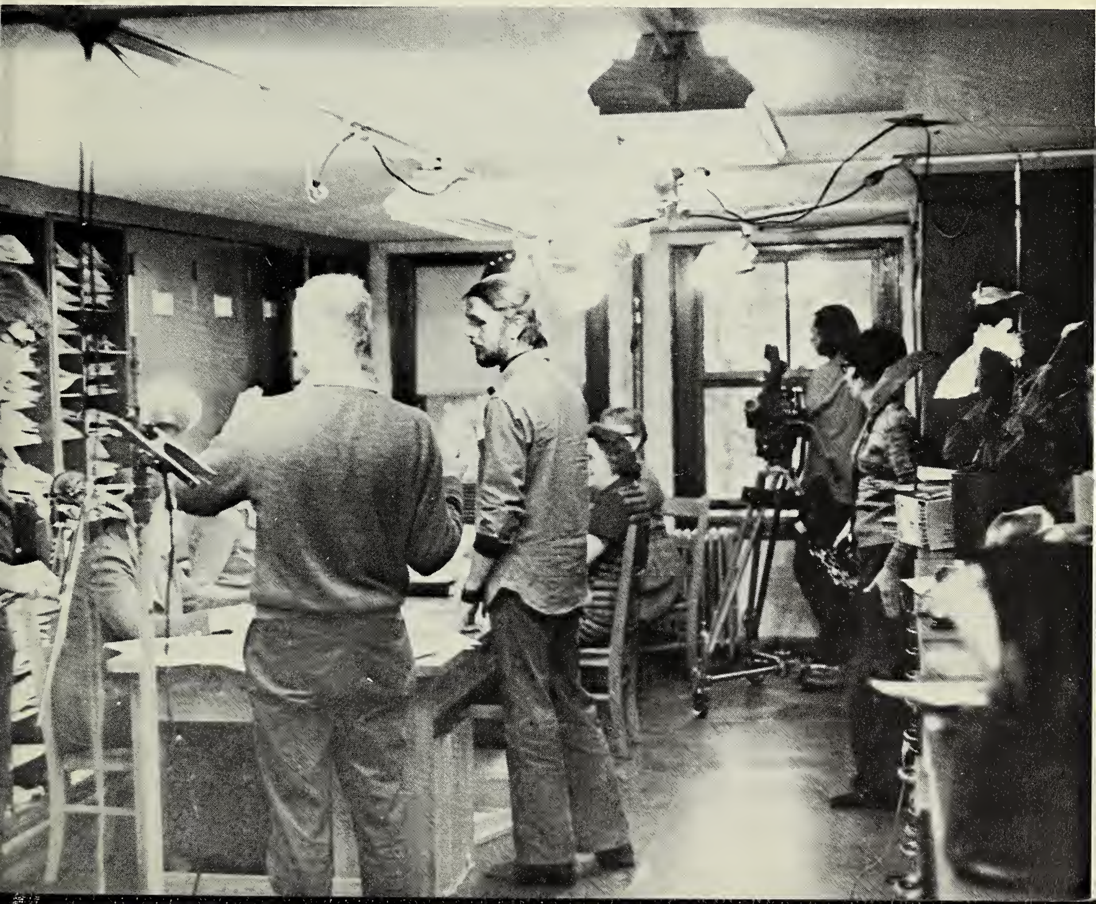
The educational activities of the Arboretum staff are many and varied. Two staff members are professors of biology, and two are lecturers at Harvard. Contact with students is at the undergraduate and graduate levels. All four staff members participated in Biology 397, a survey of research topics in biology offered for new graduate students. Dr. Schubert continued the guidance of the graduate program of Mr. Sousa-Sanchez, and was appointed an undergraduate advisor. Drs. Schubert and Wood conducted the weekly seminars in botany held in the Harvard University Herbaria building.

Thalassa Cruso, Channel 2 producer Rick Hauser, and Arnold Arboretum herbarium technician Hazel A. McDonald discuss sequence for "Changing Seasons". *Photo: P. Bruns*

Courses in botany, horticulture and natural history are offered to the public in Jamaica Plain and in Weston. The very practical courses in gardening techniques, maintenance of plants, and plant propagation continue to be the most popular. Field walks stressing identification and ecology are offered in the spring and fall.

The staff is often asked to present special lectures or seminars at other schools or for classes which visit the Arboretum. Mr. Fordham is responsible for such groups visiting the greenhouses. Approximately 80 lectures were given by the staff outside of the Arboretum during the year. International coverage was obtained during the year when Dr. Howard made a special broadcast for the Voice of America program. Channel 2, the Boston educational television station, has produced a film on the Arnold Arboretum under the guidance of Thalassa Cruso. This program, to be released to the educational network in late autumn, was prepared with considerable assistance from many members of the staff.

Channel 2 crew on location. Photo: P. Bruns.



The assembly of educational displays on the Arboretum for libraries in Massachusetts was part of the Centennial program. In addition, the Arboretum staff arranged displays of fruits for the fall show of the Massachusetts Horticultural Society and that of the Worcester County Horticultural Society. At the New England Spring Flower Show, the Arboretum exhibit featured the ornamental plants first introduced into cultivation by the Arnold Arboretum. Three educational displays of plant material appropriate for the Christmas season were staged at the Administration Building, the Massachusetts Horticultural Society, and the Boston Center for the Performing Arts.

Not the least of the educational activities involves the training of students in the regular work program of the Arboretum. We have in the past cooperated with several colleges by offering work-study programs. Students from such programs have been used in the herbarium or library or on the grounds. Applications from students have increased for employment as laborers on the grounds or for work in the greenhouses. The number that can be accommodated is limited by the supervision they require, and the amount of money available for temporary help; not by the amount of work needed to be done. Avowed students of horticulture or botany are given priority, which proves to be difficult when applied to needy Harvard-Radcliffe students. Those who are accepted for work in Jamaica Plain or Weston are required to attend two hours of formal lectures during the work week. In the course of the summer the students thus receive instruction in the "why" of their efforts, and have the opportunity of hearing from the majority of the staff on the "what" of the Arnold Arboretum.

Meetings

The Arnold Arboretum was honored by the local chapter of the Society of the Sigma Xi, which dedicated its spring program to observance of our Centennial. Dr. William T. Stearn of the British Museum, Dr. P. Barry Tomlinson of the Harvard Forest, and Dr. Howard were the speakers of the evening program.

The annual meeting of the Northeast Section of the American Society of Horticultural Sciences was held at the Arboretum, with the theme "A Century of Horticultural Progress". Dr. Howard spoke on some of the contributions in ornamental horticulture by the staff of the Arnold Arboretum; other papers concerned fruits and berries and vegetable crops of New England.

Arnold Arboretum exhibit in New England Spring Flower Show.
Photo: P. Bruns

The staff was represented at such national meetings as the International Plant Propagators Society, International Lilac Society, American Institute of Biological Sciences, American Association of Botanical Gardens and Arboreta, American Horticultural Society, and the Shade Tree Conference. At each meeting one or more staff members presented a research paper or took part in a symposium.

Travel and Exploration

International travel of the staff was associated with their research programs. Dr. Hu was in Hong Kong and the New Territories. Dr. Nevling made collections and observations in Veracruz, Mexico. Dr. Howard returned to St. Vincent to make observations and collections around the newly active Soufrière volcano, and stopped in Puerto Rico on the return trip. Mr. Pride combined vacation with field collecting in Mexico, Guatemala, Venezuela and Peru. Mrs. Derderian and Mr. Vining were in Japan to obtain photographs of bonsai for their writings.

Mercer Fellows

The Mercer Fellowship Program is designed to permit individuals to work with the collections of living plants, herbarium specimens or books, or with staff on special projects. Mercer Fellows for all or part of the year were the following:

Harmony Clement (Massachusetts) — Development of horticultural meetings.
Nancy Page (California) — City beautification and education programs.
Christian Puff (Austria) — Nodal and petiolar anatomy.
Mario Sousa-Sanchez (Mexico) — Studies of *Lonchocarpus*.
Leslie Joan Spraker (Indiana) — Horticultural writing.
Donald Vining (Georgia) — Plant propagation and bonsai.

Gifts and Grants

The Arnold Arboretum has been particularly fortunate in the Centennial year to have generous support from the many Friends of the Arnold Arboretum, both in financial terms and in material gifts. Special appeals were made for funds to support the Centennial activities, to which individuals and corporations responded. We are exceedingly grateful to all. Gifts received over and above the actual costs of the Centennial will be capitalized as the Centennial Fund, the income to be used for the general purposes of the Arboretum.

Regrettably, the University would not grant permission for a major fund drive to add professional people to the staff, to modernize the administration building, and to increase the operating budget of the Arboretum. We sincerely hope the Friends will continue their annual support of the institution, its resources, and its programs.

Two special funds were established by gifts from George R. Cooley and Mrs. Irving Fraim, the income to be used to support field work and travel. One anonymous gift was designated to be used to begin work on a revision of Rehder's *Manual.* Support through gifts of the Massachusetts Society for the Promotion of Agriculture and the American Nurserymen's Association represented professional interest in our activities in the distribution of plants.

Among the special gifts, some mentioned previously, were over 100 clay pots for the propagules of old bonsai specimens in the Arboretum collection. Mrs. Ara Derderian commissioned a Japanese artisan to design and mark these containers in honor of the Arboretum Centennial. The propagules are the result of clippings saved by Mr. Fordham and Mrs. Derderian during the pruning and training of the aged bonsai; after rooting, the young plants are trained as small bonsai.

Also as a Centennial gift were several thousand one-year plants of *Cercidiphyllum* grown by the Princeton Nurseries from seeds we supplied. These plants, obtained with the cooperation of Mr. William Flemer, were distributed in the spring in mailing tubes to Friends of the Arnold Arboretum. Special plants were donated for our collections, including the large *Sequoiadendron* from the Hovey family with the kindness of Boston College. John Vermuelen and Sons, Mr. Layne Ziegenfuss of Hillside Gardens, and Mr. and Mrs. Paul Rogers all contributed sizable numbers of plants for special educational collections.

The libraries profited from the gifts of many volumes of books, always welcome whether new to our holdings or second volumes to reduce circulation damage. The library received a gift from the New England Botanical Club in appreciation of services rendered to its members by the library staff. A grant was received from the Council on Arts and Humanities of the Commonwealth of Massachusetts for the repair and reconditioning of 17th and 18th century books in our collections. This gift was conditional on matching funds, and members of the Visiting Committee supplied the needed amount.

The work of Dr. Carroll Wood on the flora of the southeastern states is supported by grants from the National Science Foundation, as is that of Dr. Lorin Nevling on the flora of Veracruz, Mexico. Miss Stephanne Sutton received a grant from the National Geographic Society to aid her work in preparing a biography of Joseph Rock.

Publications

Regular publications of the Arnold Arboretum are the *Journal of the Arnold Arboretum*, with a distribution of 650, and *Arnoldia*, with a circulation of 2500. Dr. Bernice Schubert, with Ellen Bernstein as assistant, edited four issues of the *Journal* representing 621 pages — 24 articles by 29 authors. Arrangements have been made with Kraus Reprint Company to reprint and distribute volumes 46 through 50 so that all fifty volumes are again available. A special cover, "Century of Trees," was designed by Karen S. Velmure, and was used on the *Journal* during the Centennial year.

With regret and with thanks we accepted the resignation of Mrs. Helen Roca-Garcia as editor of *Arnoldia*. Mrs. Jeanne S. Wadleigh was appointed editor in June. Six numbers of *Arnoldia* contained 394 pages, and a special large issue was devoted to colonial gardens. The demand for this number soon exhausted the supply, and arrangements were made for the text to be reprinted and issued in hard cover by the Barre Press during late 1972.

Two special publications were issued during the Centennial year. A descriptive Centennial program was compiled by members of the committee. A booklet entitled *Early Botanical Books* was prepared by Pamela Bruns, Beverly Croyle, Gordon DeWolf, Sheila Geary, Charles Long, Kenneth Robertson, Carol Shweder and Richard Weaver. This was planned to accompany an exhibit of unusual botanical volumes, but stands alone as a literary and bibliographic contribution. A new directional map to reach the Arnold Arboretum was designed by Pamela Bruns for distribution through tourist information centers. Miss Bruns also was responsible for preparing the sets of kodachrome slides of the Arboretum collections, which are offered for sale.

RICHARD A. HOWARD

Strawberries, Fragaria Major.
From Fuchs, De Historia Stirpium.

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New hillside planting of bulbs draws young admirer. *Photo: W. Hebb*

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1971–1972

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* Appointed jointly with the Gray Herbarium.
** Resigned, Jan. 1, 1972.
† Resigned, Jun. 30, 1972.

Plant Registrations

Every so often during the past 11 years new cultivars of woody plants registered by the Arnold Arboretum have been published in *Arnoldia*. (See *Arnoldia*, Vol. 21: 9–18; 31–34; 39–42; 47–50. Vol. 23: 17–75; 77–83; 85–92; 111–118. Vol. 24: 1–8; 41–80. Vol. 26: 13–16. Vol. 27: 16–66. Vol. 29: 1–8. Vol. 30: 251–260).

Included in this issue are those cultivars which have been registered between October 1, 1970, and October 1, 1972. All correspondence concerned with more information, plants, or propagating material of these plants, should be directed to the various originators or introducers, not the Arnold Arboretum.

Cornus kousa 'Steeple'

A form of Japanese Dogwood grown by Mrs. Julian W. Hill, Barnard's Inn Farm, Vineyard Haven, RFD, Mass. 02568 from seeds sown in 1961 from a tree growing on the property of M. M. Brubaker, Chadds Ford, Pennsylvania.

The distinguishing feature of Mrs. Hill's plant is its extremely fastigiate habit of growth which gives it the appearance of a slender spire. The leaves are heavy in texture and dark, glossy green in color. Flowers are normal for the species. The plant has adapted well to the dry, well-drained sandy soil on the Island of Martha's Vineyard. It has not been introduced commercially.

Cornus stolonifera 'Cheyenne'

This originated at Inter-State Nurseries, Hamburg, Iowa 51640 in 1957 as a seedling of *Cornus stolonifera coloradensis*. It was originally described in the Inter-State Nurseries catalog for spring, 1967.

In the words of Mr. L. B. Sjulin of Inter-State Nurseries . . . "Quite a number of years ago we saw *C. stolonifera coloradensis* at the U.S.D.A. Cheyenne Station. We thought it was a good shrub so we gathered some seed and brought it home and grew some. We did this for several years and noticed there was a big variation in the plants, there was quite a difference in the foliage, particularly in the resistance to disease and in the fall coloring of the leaves and bark. So we started to make selections. We gradually got down to one single plant . . . This plant has more resistance to foliage diseases than any *Cornus* we have ever had. In most falls it gets an attractive reddish coloring, blooms freely all through the season and also has a good red winter bark.

"The *C. alba* 'Siberica' selections have brighter bark, but all of them, and we have tried a number of varieties, have very serious foliage trouble. The regular *C. stolonifera* is too uneven and also is subject to foliage disease and so is *C. baileyi* but to a lesser degree."

The plant is hardy in Zone 4 (Arnold Arboretum Plant Hardiness Zone Map) at least, and perhaps in Zone 3. It can be expected to thrive in any ordinary soil, and does well in alkaline soil such as in western Nebraska and Wyoming.

Gleditsia triacanthos inermis 'Royal Green'

A new form of the Thornless Honey Locust which originated as a chance seedling at Shenandoah Nurseries, Shenandoah, Iowa 51601. It was first offered to the wholesale trade in 1970 as "Lakes #2." The name has been registered by the W. Atlee Burpee Co., Hunting Park Avenue at 18th Street, Philadelphia, Pennsylvania 19132, and is being offered to the trade through Shenandoah Nurseries. In the words of Mr. Jack Young of W. Atlee Burpee Co. . . . "The selection is characterized by a straight sturdy trunk, is thornless and of more compact upright habit than the regular Thornless Locust. Foliage is substantial of good dark green color. It has been found to do well in either wet or dry soils."

Juniperus chinensis 'Gold Star'

This handsome Juniper originated in 1961 as a sport of *Juniperus chinensis* 'Pfitzeriana Aurea' at the J. C. Bakker & Sons Nursery, Ltd., RR3, St. Catherines, Ontario, Canada. It was first propagated in 1963. The plant, which is comprised largely of juvenile foliage, is denser and lower growing than its parent. The bright yellow-gold foliage is also more intense than the parent and other *J. chinensis* cultivars such as *J.* 'Old Gold'.

The name was registered in 1971 with the Canadian Ornamental Plant Foundation, COPF, Carlisle, Ontario, Canada. The U.S. assignee is The Conard-Pyle Co., Star Roses, West Grove, Pa. 19390. Patent was applied for, but pending at the date of registration in March, 1972.

Plants of this cultivar are now represented in our collection at the Arnold Arboretum, and although still small, appear superior to other golden-yellow forms which we have available for comparison.

Larix decidua 'Paula'

The original plant was discovered in Hamden, Connecticut in 1962. It is characterized by its ascending branches and distinctly blue needles which are 1 1/2 to 2 inches long. Although the plant is not at present in commercial cultivation, the introducers are: Mr. Vincent P. Bonaminio, Department of Horticultural Science, North Carolina State University, Raleigh, North Carolina, and Dr. Edwin D. Carpenter, Department of Plant Sciences, University of Connecticut, Storrs, Connecticut 06268.

Malus 'Albright'

This is registered by Mr. R. E. Harris, Research Station, Canada Department of Agriculture, Beaverlodge, Alberta, Canada. Mr. Harris is also the introducer. The plant was originally raised by Mr. W. O. Albright of Beaverlodge, Alberta in 1948 as a seedling of *M. baccata.* The male parent is unknown. Complete information for a description of this cultivar is lacking at present, but we do know that it has large, pink flowers and fairly large, dark-red fruits.

Malus 'Arctic Red'

This is a second registration from Mr. R. E. Harris, Research Station, Canada Department of Agriculture, Beaverlodge, Alberta, Canada. The originator is Mr. J. A. Wallace, also of Beaverlodge, who grew it in 1928 as a seedling of *Malus* 'Osman'. The parent plant is approximately 44 years old.

This cultivar is noted for its extreme hardiness and fruiting ability in northern Alberta. Further description did not accompany the registration, but the name was first published in the Canadian Journal of Plant Science 50:511. The name has also been registered with the Canadian Ornamental Plant Foundation, COPF, Carlisle, Ontario, Canada.

Malus 'Springtime'

Mr. Robert J. Hilton, University of Guelph, Guelph, Ontario, is the originator of this new cultivar. It will be introduced commercially in 1973 by the Sheridan Nurseries, Ltd., 100 Sherway Drive, Etobicoke, Ontario, Canada. It originated in Rockwood, Ontario, Canada, as a chance seedling from unknown parents. Mr. Hilton describes the plant as being similar to *M.* 'Dorothea' but the foliage is paler green, the shoots have more prominent lenticels, the flowers are initially a deeper pink color and the fruits are more golden and closer to *M. baccata* in form. It is hardy in Zone 5 of the Arnold Arboretum Plant Hardiness Zone Map and currently under trial in Zone 2. The original description for *Malus* 'Springtime' is to be found in the Canadian Horticultural Council Research Report for 1971.

Malus 'Sylvanna'

Dr. Earl H. New, who is the introducer, gives the following description for this cultivar: "A vigorous growing, open pollinated seedling of *M.* 'Redflesh' which is characterized by more intense coloring of the leaves, flowers, and fruits. The fruit is shaped and sized more like that of some of the larger fruited *M. pumila niedzwetzkyana* vars. The fruit flesh is darker than *M.* 'Redflesh', approaching crimson in some of the smaller fruits. The seed coats are reddish. The wood in the twigs is reddish as in *M.* 'Redflesh', *M.* 'Hopa' and others derived from the red vein crab. The fruit size will vary from 1 1/4 to 1 3/4 inches. Flowering and fruiting are annual and heavy. The fruit makes excellent red jelly and a tart red apple butter. It is apparently resistant to most of the major diseases. Scab appears on the fruit and leaves but does not defoliate the tree. It should be sprayed for worm control if the fruits are to be used. At Strawberry Point, Iowa, the fruit matures in late August about with *M.* 'Redflesh' and *M.* 'Dolgo'. The tree has an irregular growth, similar to *M. hupehensis*, which is more striking as fruit loads bend the branches. The reddish leaf color is darker and retained longer in summer than that of *M.* 'Redflesh'. The leaf color is not as red nor as persistent as that of *M.* 'Royalty'."

The parent tree is approximately 20 years old and is growing on the property of the originator, Mrs. Enno Burrack, 401 W. Mission Street, Strawberry Point, Iowa. Dr. Earl H. New, Agricultural Department, Middle Tennessee State University, Murfreesboro, Tennessee expects that the plant will be available commercially. Bud wood was sent to Glenn's Nursery, Route 4, Box 332, McMinnville, Tennessee 37110 in August, 1971. The plant is fully hardy in Zone 4 and perhaps in most of Zone 3.

Pieris japonica 'Valley Rose'

This originated at the North Willamette Experiment Station, Rt. 2, Box 254, Aurora, Oregon 97002 as a cross made in 1961 by Prof. Robert L. Ticknor, between *Pieris japonica* 'Flamingo' and an unnamed deep pink form of *P. japonica* obtained from the Mitsch Nursery in Oregon.

It has a spreading habit of growth, the original plant being 30″ tall by 42″ wide after ten years. It blossoms a week later than other cultivars. The winter bud color is red (RHS Red-Purple, Group 59A), and the open flowers are pink (RHS Group 61D).

Prof. Ticknor says it should be adaptable to Zone 5 of the Arnold Arboretum Plant Hardiness Zone map. Although the plant has not yet been introduced commercially, it will be, as stock plants were released to Oregon propagators in 1971. A specimen of this is now in our collection at the Arnold Arboretum and is being observed for performance under our conditions.

Pinus ponderosa 'Canyon Ferry Dwarf'

This is registered by Mr. Clayton Berg, The Valley Nursery, Box 845, Helena, Montana 59601. In 1966 Mr. Berg discovered a witches'-broom growth on an old specimen of *P. ponderosa* growing along the east shore slope of the Canyon Ferry Reservoir, Lewis and Clark County, Montana. Scion material was sent to the Morton Arboretum in 1969, and the resulting plants are to be given the name of their point of origin.

Pinus strobus 'Lenore'

Mr. Henry Vaughn-Eames, RD 1, Stockton, New Jersey 08559 discovered the original plant in the middle of a plantation of three or four thousand white pines while scouting for plants to use on a state highway planting. The seedlings originally came from the Washington Crossing New Jersey State Nursery and were planted as a soil conservation measure in Somerset County near Far Hills, New Jersey about 1952.

The plant has been registered for Mr. Vaughn-Eames by Dr. Robert B. Clark, Plant Taxonomist, Highland Park Herbarium, 375 Westfall Road, Rochester, New York 14620. It is characterized mainly by its extremely fastigiate habit and differs from *P. strobus* 'Fastigiata' in the shortness of its branches.

The original specimen which has been moved to Mr. Vaughn-Eames' property in Stockton, New Jersey is over twenty feet tall and only six feet wide. From a photograph supplied by Mr. Vaughn-Eames, the uppermost branches appear to be spreading considerably more than the lowermost, but the plant is still distinctly more columnar in form than *P. strobus* 'Fastigiata'.

Mr. Vaughn-Eames has donated a small specimen to be grown and observed in our collection at the Arnold Arboretum.

Prunus armeniaca 'Autumn Royal'

This originated at the L. E. Cooke Co., 26333 Road 140, Visalia, California 93277, and was first offered in the L. E. Cooke Co., nursery sales catalog for 1969. It is a sport Blenheim Apricot and bears Plant Patent No. 2906. It is described as a new and distinct variety of Apricot, which is large, vigorous, vase-shaped and densely branched. It is self-fertile and very productive, bearing medium sized, freestone fruit which ripens approximately seven weeks later than the Royal Blenheim apricot. The skin at the suture line is pronounced.

Hardiness outside the San Joaquin Valley, California is unknown, but the L. E. Cooke Company has provided the Arnold Arboretum with young plants of this and the next two cultivars for observation in our collection.

Prunus armeniaca 'Golden Amber'

This was originally raised by Mr. Willard Clayton Hill, 3430 S. Santa Fe Avenue, Visalia, California. The introducer and patent holder is the L. E. Cooke Company, 26333 Rd. 140, Visalia, California. (Patent No. 3067). It was first described in the 1969 sales catalog of the L. E. Cooke Company.

The plant is characterized as being a new and distinct variety of apricot tree which is large, vigorous, vase-shaped, and densely branched. It is self-fertile and very productive, regularly bearing large sized, freestone fruit. This variety has a long progressive blooming and ripening period, and its pit is burn resistant. At present, its hardiness is unknown outside the San Joaquin Valley, California.

Prunus 'Purple Pony'

This purple-leaved variety of Flowering Plum is also an introduction of the L. E. Cooke Co., 26333 Rd. 140, Visalia, California 93277. The originator is Mr. Walter Krause of Reedley, California who found the original plant at Merced, California in 1962. The parent plants are unknown. It has not yet been introduced commercially, and is still undergoing trials at the L. E. Cooke Co., and on the East Coast at the Arnold Arboretum.

The plant is described by Mr. G. R. Daniels, Production Manager for the L. E. Cooke Company as being a semi-dwarf which grows at about only 60% of the rate of the well known *P.* 'Thundercloud', another purple-leaved variety. It has the characteristic of holding its purple color in temperatures above 100 degrees, leaves being as intensely colored at the end of the growing season as the beginning. In observations of this variety since 1962, it has not produced a single fruit. Blossoms are single-pink.

Hardiness is presently not known outside the San Joaquin Valley, California. However, the Arboretum is now growing plants at the Case Estates which were supplied by the L. E. Cooke Company. Should it prove hardy, and adaptable to other conditions here, it would be worthy of much greater trial, as in our own observations we found the foliage color to be better (more reddish-purple) than other varieties in our collection, and on young plants it was retained better at the end of the growing season.

Taxus baccata 'Davie'

A new variety of English Yew which "volunteered" in the garden of Mrs. David Metheny, 2801–46th Avenue West, Seattle, Washington 98199 about nine years ago.

A description of the plant received from Mrs. Metheny in December, 1970 states that . . . "At the present date the tree is 23 cm. high, with a maximum spread of 11 cm. Trunk diameter at ground level is 1 cm. Branching pattern is ascending to erect and compact. Leaf length to 1.5 cm. Mature leaf color is basically dark green (RHS Horticultural Color Chart 136 B), with margins and distal ends pale yellow-white (158 D) where exposed to light."

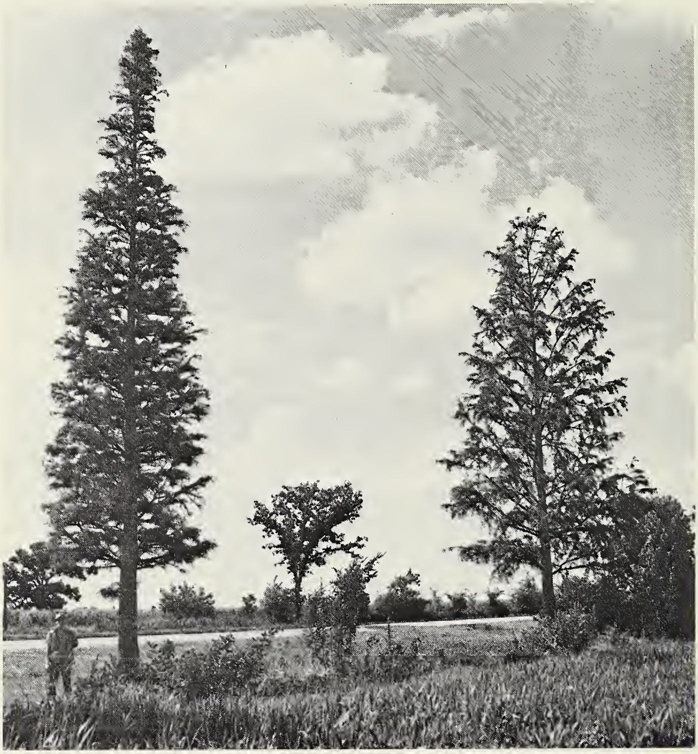
Hardiness is presently unknown. In Mrs. Metheny's garden the plant exhibited no damage at all, in an unprotected location, from low temperatures of 15°F in January, 1963 and 9°F in December, 1968.

Taxodium ascendens 'Prairie Sentinel'

Mr. Earl Cully of the Cully Nursery, RR #5, Jacksonville, Illinois 62650 deserves credit for searching out and introducing superior forms of the Pond Cypress, *Taxodium ascendens*, and the Bald Cypress, *T. distichum*, two native American trees whose horticultural potential has for too long been neglected. This, and the following cultivar are the latest introductions from the Cully Nursery.

T. ascendens 'Prairie Sentinel' was first observed in December, 1968 growing in White County in Southeastern Illinois. Mr. Earl Cully describes its main distinguishing characteristics from other forms of Pond Cypress as: 1.) its more rapid growth in height; 2.) its distinctive angle of numerous primary branches which leave the main stem at an angle of 65° to 70° below the vertical, and 3.) the very uniformly short branch length, the length of its lower branches not exceeding one-twelfth of the tree's height. The original specimen is estimated to be approximately 30 years old. Mr. Cully further states that the plant is hardy in all of Zone 4 and the southern part of Zone 3. It will grow well in a very moist soil and also is equally suited to an upland site. It is very tolerant of air pollution. Patent is being applied for.

Readers in the Boston area are probably unfamiliar with the horticultural possibilities for *Taxodium* here, even though several specimens can be seen in the Arnold Arboretum. They are usually thought of as trees of the Cypress swamps of the south and generally not presumed hardy this far north. One of the better specimens in our collection is growing by one of the ponds near the Shrub Collection, a site which has long been considered the coldest spot in the Arnold Arboretum, generally approximating Zone 4 conditions of the Arnold Arboretum Plant Hardiness Zone Map. Two other plants are in the Meadow, another moist lowland site also considered a frost pocket.



Taxodium *'Prairie Sentinel', left, and common Pond Cypress, extreme right. Photo: E. Cully.*

To say that much more experimentation with the two hardy species of *Taxodium* should be undertaken in the Boston area would be an understatement, and for this reason we are quoting here portions of a letter which Dr. J. C. McDaniel, Assistant Professor of Horticulture, University of Illinois, Urbana, Illinois, sent to Mr. Earl Cully in February, 1971:

"Because this genus, in the U.S., has been a source of choice timber, its value for ornamental planting has tended to be overlooked. I think that in the future its imaginative landscaping use will probably outweigh its strictly forestry use. In some respects *T. distichum* may be the most adaptable of all the gymnosperms. Native from Southern Florida and Texas up to Delaware and Illinois, it has been cultivated successfully as far north as Minnesota, and in Ottawa, Canada. Add the Mexican species (*T. mucronatum*), and the native range (in the highlands) goes clear south to Guatemala . . . *T. ascendens*, the Pond Bald cypress, though more restricted in its southeastern natural distribution, has accompanied the common Bald cypress, *T. distichum* in northern plantings, and seems equally hardy and perhaps even better adapted to soils with higher salts content and less than optimum aeration. . . . They are by no means confined to permanently wet soils, but can compete with most trees for use on upland sites.

"Besides having greater north to south adaptation than any of the other deciduous gymnosperms (including *Ginkgo*), *Taxodium*, I believe, excels the other deciduous conifers (*Larix, Pseudolarix, Metasequoia*) in winter interest. In particular, it does not have the dead tree look of a leafless *Larix.*

"Cypress knees are general with *T. distichum* growing in wet soil (waterside, or with a generally high soil-water level) . . . *T. ascendens* generally lacks knees, but in Florida will develop them on a low percentage of trees in certain native stands.

"The greatest field for selection is in clonal variation for vigor, branching character and foliage quality. While broad-spreading trees are more common in *T. mucronatum*, and narrow crowns more prevalent in *T. ascendens*, both of these types can be found within the variable *T. distichum*. Even *T. ascendens* has some individuals and populations with spread equalling or exceeding height. For northern use, the preference may go to trees that show relatively early change to the attractive red-brown autumn coloration. *T. ascendens* generally, and many trees in *T. distichum* show a lack of noticeable spider mite infestation which can consistently damage the appearance of some more susceptible clones in midsummer. Resistant trees would have a considerable advantage for general planting.

There are apparently clones highly resistant to infestation by the gall-forming insects that (as far north as Urbana) can be profuse on many other clones in the same planting. . . .

"You and others have proved the clonal uniformity of grafted trees, the relative ease of grafting, and the lack of incompatibility in *Taxodium/Taxodium* graft combinations. Some degree of success has been had here with rooting *T. distichum* cuttings, even from old clones, but much less than with the more evergreen *T. mucronatum*, in which it is considered commercially feasible . . . more experimenting needs to be done on cutting rooting with both *T. ascendens* and *T. distichum*, but meanwhile, grafting of cultivars from both these species is quite practical as a nursery method.

"Some selection of seed sources for nursery propagation is in order. While the seed source, within *T. distichum*, seems to have little influence on the hardiness of seedlings (some from near Orlando, Florida have been quite hardy at Gilman, Illinois), Anderson, at the Missouri Botanical Garden, found seedlings from southwest Texas to excel others in being unappetizing to rabbits in their earlier years, probably as a result of natural selection.

"Beauty is in the eyes of the beholder, of course, but we are in good company in regarding bald cypresses (in the northern states) as aesthetically graceful, rugged trees. Under more southern swamp conditions, where festooned with Spanish moss, the word for bald cypress may be picturesque, rather than beautiful. But we are considering it as a tree for cultivation in the man-made landscape, outside the southern swamps, and here, think it has a combination of desirable features not quite matched by any other large growing deciduous trees. With named cultivars, we can repeat and emphasize the beauty of an individual by using avenues of the same uniform clone, or else plant a grove of contrasting clones, with ascending and spreading trees together. The Mexicans have adopted *T. mucronatum* as their national tree. With good reason, *T. distichum* and *T. ascendens*, once they are available in superior cultivar forms should be very prominent among the really choice ornamental trees planted north, way north, of the border."

Taxodium distichum 'Shawnee Brave'

This is a second registration from Mr. Earl Cully, Cully Nursery, RR 5, Jacksonville, Illinois 62650. The original plant is growing in Johnson County, southern Illinois and is approximately 40 years old. It was first observed by Mr. Cully in 1968 and propagated in 1969. Mr. Cully lists the following characteristics for this new cultivar: 1.) Rapid straight growth of its central trunk; 2.) Abundant production of lateral primary branches; 3.) Angle of branching 45° to 50° below the vertical for the primary branches, and secondary and tertiary branching usually at increasing angles from the top of the tree downward giving a fuller than usual crown to this tree; 4.) Relatively short branches resulting in a tightly pyramidal crown.

The plant is hardy in Zone 4 and the lower half of Zone 3. It will grow well in soils ranging from pH 4 to 7 in both moist lowland situations and upland sites. It is tolerant of air pollution. Patent was being applied for as of the date of registration in October, 1971.

Tsuga canadensis 'Narragansett'

Mr. James W. Brandley, 212 Lowden Street, Pawtucket, Rhode Island 02860 discovered the original as a bud sport growing on a specimen of normal *Tsuga canadensis* in Providence, R.I. in 1958. In Mr. Brandley's words, "The original sport was roughly round, low and spreading and concave. It was approximately two feet in diameter and, judging from the annual growth, was about twenty years old. It was growing on a branch about ten feet from the ground in dense shade. Two years later it died."

An original graft from the above was sent to the Arnold Arboretum in 1964 by Mr. Brandley.

Robert S. Hebb

Notes from the Arnold Arboretum

ARNOLD ARBORETUM WEATHER STATION DATA
1971

Average temperature for 1971: 50.8°
Precipitation for 1971: 36.73 inches
Snowfall during winter 1970–1971: 38.8 inches
Warmest temperature: 97° on July 10, 1971
Coldest temperature: −9° on January 19, 1971
Date of last frost in spring: April 28, 1971
Date of first frost in autumn: November 5, 1971
Growing season for 1971 was 190 days *

	Avg. Max. Temp.	Avg. Min. Temp.	Avg. Temp.	Extreme Max.	Extreme Min.	Precipitation
Jan. 71	33.1	11.2	22.2	47	−9	1.81
Feb. 71	37.8	21.3	29.6	53	−1	5.02
Mar. 71	45.4	28	36.7	65	20	2.93
Apr. 71	55.9	35.5	45.7	76	27	2.75
May 71	67.3	46.4	56.9	84	38	4.07
June 71	82.8	55.9	69.4	95	41	1.40
July 71	87.6	61.9	74.8	97	49	2.81
Aug. 71	86.7	61.4	74.1	95	44	2.35
Sept. 71	77.9	56.9	67.4	94	40	1.86
Oct. 71	70.6	46.6	58.6	87	37	2.50
Nov. 71	49.9	31.7	40.8	77	19	6.62
Dec. 71	43	24	33.5	64	8	2.61

* Growing season — The growing season is defined as the number of days between the last day with killing frost in spring and the first day with killing frost in autumn. This time is determined by the last spring and the first fall temperature of 32 degrees F. or lower.

ALFRED J. FORDHAM

Left: Sambucus canadensis. *Photo: P. Bruns*

ABNORMAL LEAF RETENTION ON INTRODUCED TREES IN AUTUMN 1971

In autumn of 1971 native trees in the Boston area exhibited a good display of colored foliage. In keeping with the normal course of events, these trees went on to shed their leaves. Some exotic trees, however, did not follow this customary pattern. Norway (*Acer platanoides*) and Japanese maples (*A. palmatum*) and European linden (*Tilia europaea*) among other subjects, did not form abscission layers and retained their leaves until long after the native trees had shed theirs.

Autumn foliage of *Acer griseum* (Paper bark maple) is usually brilliantly tinted from yellow through orange to deep red. In 1971 its leaves did not undergo color change and remained on the trees until November 22nd when they were pulled from the branches by a four-inch fall of wet, clinging snow.

The extraordinary leaf retention on trees not native might be explained by the exceptionally mild autumn weather that prevailed in 1971. Figures kept at the United States Weather Bureau in Boston reveal the following: Summer of 1971 proved to be the sunniest in 14 years and the warmest in 16 years. Temperatures for September and October exceeded normal by 3 and 5 percent respectively. In fact, the third warmest October in the 142-year history of the Boston Weather Bureau occurred in 1971.

In December of 1971, the author visited Longwood Gardens, Kennett Square, Pa., Kingsville Nurseries, Kingsville, Md., the U.S.D.A. National Arboretum, Washington, D.C. The phenomenon of abnormal leaf retention similar to that seen in Boston was noted at these locations, as well as in other parts of the northeast.

The trees which retained their leaves went through the usual stages of hardening in preparation for surviving the cold of winter. All those under observation foliated in a normal manner with the advent of spring.

ALFRED J. FORDHAM

Right: Acer griseum. *Photo: P. Bruns*

Arnoldia Reviews

The Arboriculturist's Companion. N. D. G. James. Oxford, Eng.: Basil Blackwell. 1972. 237 pages, illustrated. 3.15 net.

The author has used an outline style to cover the broad field of arboriculture from the selection of the proper tree through the legal responsibilities and regulations. In some instances detail and reasons for his recommendations are not as complete as might be desired, especially by one not already conversant with the practices.

Any reader not in Great Britain will need to interpret some of the terms and must realize differences in legal regulations and responsibilities. Two forms which had me guessing the first time or two I read them were hessian (we call it burlap) and secateurs (we call them hand pruning shears).

A "companion" to the arboriculturalist to remind him of all the phases of tree culture.

R. G. W.

The White Flower Farm Garden Book. Amos Pettingill. New York: Alfred A. Knopf. 1971. 365 pages, 215 line drawings, 36 half-tones, one map. $10.00.

Most gardeners are familiar with the nursery catalog called "The Garden Book" if for no other reason than that it costs $2.50. It is published by the White Flower Farm of Litchfield, Connecticut and has been described as a "notoriously truth-speaking catalog . . . with useful, bluntly informative advice." The author of the **White Flower Farm Garden Book** claims that it is not just this catalog put between hard covers. The publisher claims there is a "wealth of new information and new illustrations" in the book. Among the new things the author has contributed are a "lively account of his gardening life and philosophy". However, it appears that almost all of the catalog is included in the book with minor changes. The catalog, for example, says *Allium giganteum* flowers last three weeks in water when cut. The book is more conservative; it says they last only two.

Included in the book are 215 excellent pen and ink drawings of Nils Hogner which add greatly to the usefulness of the book.

The 36 half-tones include seven pictures of the author; five with a pipe in his mouth and two without.

As almost everyone has known for some time, the whimsical name Amos Pettingill is the pseudonym of William B. Harris, the owner of White Flower Farm and now the author of this book. There is no questioning the fact that the catalog is a mine of tartly presented and especially helpful advice to the gardener. It will be up to the buyer to decide whether or not the additional material supplied by the author and the hard cover are worth the difference of $7.50.

G. H. P.

Diseases of the Cultivated Plants of the Southwest. Rubert Burley Streets, Sr. Tucson: University of Arizona Press. 1969. 390 pages, illustrated. $9.50.

Each section of the country has its own particular disease problems, but a group of diseases remain that are found throughout the country. It is on this basis that this book is noticed here. The descriptions of the diseases are clear and, most important, the black and white photographs generally seem to show that which they were intended to illustrate. The book is well produced and seems well worth the modest price.

G. P. DeW.

Plant and Soil Water Relationships: A Modern Synthesis. Paul J. Kramer. New York: McGraw-Hill. 1969. 482 pages, with illustrations and diagrams. $16.00.

The college textbook type of literary production is not generally a very easy kind of book to digest. The ponderous style is more conducive to sleep than to appreciation. However, the book under notice is important for anyone concerned with the problems of tree growth; in particular, tree growth in cities. The parameters imposed by soil conditions are among the most important limitations a tree has to face. This book is a useful synthesis by the acknowledged authority on plant-water relationships.

G. P. DeW.

Topiary and Ornamental Hedges. Miles Hadfield. New York: St. Martin's Press. 1971. 100 pages, illustrated. $12.50.

Either you like topiary or you don't; I've never met anyone who was lukewarm on the subject. If you do like topiary, you also will like this book. Miles Hadfield sets his history of these "elaborate artificialities" in the social and intellectual context of the times which produced them and makes topiary an expression of its age rather than a pruner's whimsy. The history takes up half of the book's 100 pages.

The rest of the book is devoted to the practical facets of the art with thirty pages running from *Acer* to *Tsuga* detailing how each species can be used as hedge or ornament. Just in case you have been wondering what to do with that overgrown *Taxus* at the corner of your house, there is a neat cake stand with handle pictured opposite page forty-nine that should solve your problem.

D. M. V.

Native Trees of Canada. 7th edition. R. C. Hosie. Ottawa: Queen's Printer for Canada. 1969. 380 pages, illustrated. $5.00.

This very fine book should prove useful to anyone interested in identifying trees, both in Canada and the northern areas of the United States. For each species there is a distribution map (only the Canadian range, however); a habit drawing; excellent black-and-white photographs of various features such as leaves, flowers, fruits, buds, bark, and habit; and a concise, non-technical description. The appendices include a section explaining the Latin names of the trees, a list of references on trees, and a very novel key in chart form. Many people are intimidated by keys simply because they find them hard to follow without previous instruction. Since this key is presented graphically, the mechanics of using it should be obvious to anyone.

R. E. W.

CHRISTMAS GIFT SUGGESTIONS

from the

ARNOLD ARBORETUM

WINTER 1972

BOOKS WRITTEN BY MEMBERS OF THE ARBORETUM STAFF

Bruns, Pamela, Rosenfeld, Mary, and Sutton, Stephanne B. — *Through the Arnold Arboretum.*

48 pp., 25 full-page photographs, and one map, 1968. $1.00

A sprightly walking tour through the Arboretum.

Guilding, L. — *An Account of the Botanic Garden in the Island of St. Vincent.*

47 pp. and 4 full-page plates, 1825. (Reprinted 1964) $5.00

An historical record of the early days of the first botanical garden in the West Indies, together with a list of plants cultivated in the garden. Reprinted in 1964 by the Arnold Arboretum as a contribution to the celebration of the Garden's bicentenary.

Howard, Richard A. — *The Flowers of Star Island, The Isles of Shoals.*

106 pp. and 25 plates, with 8 full-page photographic views, 1968. $2.50

The Isles of Shoals, lying ten miles off Portsmouth, New Hampshire, have long been a summer refuge for New Englanders. Star Island, with its rambling wooden hotel, is now a religious conference center. This is an annotated and illustrated layman's account of the vascular plants known to occur on Star Island.

Sutton, Stephanne B. — *The Arnold Arboretum: the first century.*

72 pp. with photographic illustrations in color and in black and white, 1971. $2.75

A brief description of what the Arboretum is, and how it came to be, as expressed by various members of the staff, past and present. The quotations are deftly connected by the artful prose of the Research Associate who also produced *Charles Sprague Sargent and the Arnold Arboretum.*

Sutton, Stephanne B. — *Charles Sprague Sargent and the Arnold Arboretum.*

xvii + 382 pp. Cambridge, Mass.: Harvard University Press: 1970.

Friends of the Arnold Arboretum	$8.50
Others	$10.00

The story of the first fifty-odd years of the Arnold Arboretum, and of its founder and first Director. The authoress, now Research Associate of the Arnold Arboretum, has breathed life into what could have been a dry-as-dust tome. Friends of the Arnold Arboretum may order directly from the Arboretum. All others should contact the publisher at: 79 Garden St.
Cambridge, Massachusetts 02138.

DeWolf, Gordon et al. — *Early Botanical Books.*

55 pp., illustrated, 1972. $4.00

A literary and bibliographic compilation published to accompany a special exhibit in the Houghton Library on the occasion of the Arnold Arboretum's Centennial Week.

* * *

For the Philatelist . . .

Envelopes with special cancellation in observance of the Centennial of the Arnold Arboretum. Commemorative stamps are used on many. As supply lasts. $1.00

Faxon Drawings for Christmas

Four of Charles Edward Faxon's botanical drawings, originally published in *The Silva of North America,* have been reprinted as Christmas cards. The cards and envelopes are available in boxes of 20 (five of each of the four cards) or individually. The drawings are in black and white, printed on heavy card stock.

The four illustrations are:

1. *Ilex opaca,* American Holly
2. *Larix occidentalis,* Tamarack
3. *Thuya occidentalis,* White Cedar
4. *Pinus ponderosa,* Yellow Pine

Price: Box of 20 cards (four illustrations) —

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NEW BOOKS JUST OFF THE PRESS

FAVRETTI, RUDY J., AND DEWOLF, GORDON P. — *Colonial Gardens.* 163 pp., illustrated. Barre, Mass.: Barre Publishers. 1972.

Friends of the Arnold Arboretum	$7.00
Others	$8.95

This work, originally published in July 1971 as a special issue of *Arnoldia*, has been reprinted with additional illustrations. It provides a reliable, documented guide to all of the plants — whether edible, ornamental, or otherwise practical — that were cultivated prior to the American Revolution. The predominant patterns of herb and flower gardens are described, and an extensive bibliography also is included. An indispensable book for the gardener with a love of history and for the history buff with a love of gardening.

DEWOLF, GORDON, AND HNIZDOVSKY, JACQUES — *Flora Exotica.* 60 pp., illustrated with 15 original woodcuts. Boston, Mass.: David R. Godine. 1972.

Friends of the Arnold Arboretum	$12.00
Others	$15.00

The flowering plants collected here, both rare and not so rare, are seen with an artist's eye and described with a scholar's precision. Printed from woodcuts made by Jacques Hnizdovsky especially for this volume, each illustration displays the engraver's fascination with botanical accuracy and graphic invention. The cuts are accompanied by Gordon DeWolf's prose commentary which conducts the reader through curious byways in the history of plant cultivation.

Unless otherwise indicated, orders for all gift items may be directed to the Arnold Arboretum, Jamaica Plain, Massachusetts 02130. Please make checks payable to Harvard University.

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The Friends of the Arnold Arboretum receive:

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2. Complimentary copies of other Arboretum horticultural publications as they are issued.
3. Reduced rates for lectures and classes.
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6. Free copy of "Through the Arnold Arboretum."

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SUPPORTING	$50.00 a year	DONOR	$1,000 or over

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Please make checks payable to Harvard University and forward to the Director of the Arnold Arboretum, Jamaica Plain, Mass. 02130.

(Such contributions are a deductible item on Federal Income Tax Returns.)

Right: Carpinus betulus. *Photo: P. Bruns*

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